Universidade de Aveiro Departamento de Biologia
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Mónica Ferreira de Oliveira

Ferramentas interativas para a divulgação da diversidade florística da Pateira de Fermentelos

Interactive tools for divulgation of flora diversity from Pateira de Fermentelos

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Ecologia Aplicada, realizada sob a orientação científica da Professora Doutora Maria Helena Abreu Silva do Departamento de Biologia da Universidade de Aveiro

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palavras-chave

Pateira de Fermentelos, Vegetação ripícola, Chaves dicotómicas ilustradas, Descrições, Divulgação cientifica.

resumo

A Pateira de Fermentelos, localizada na região de Aveiro, é considerada uma das maiores lagoas naturais da Península Ibérica. Constitui um importante ecossistema aquático e terrestre para diversas espécies de avifauna, e possui um papel fundamental para a população local e regional que nela desenvolvem inúmeras atividades recreativas e agrícolas. Atualmente, devido à atividade industrial envolvente, à utilização de pesticidas e herbicidas nas culturas agrícolas, à falta de dragagens e à propagação de espécies invasoras, o estado ecológico da lagoa tem vindo a deteriorar-se.

Esta dissertação pretende contribuir para o conhecimento e conservação do património botânico e perspetivá-lo em termos de educação ambiental, ao permitir a sua utilização como recurso pedagógico e didático. O levantamento florístico da Pateira de Fermentelos compreendeu os habitats aquático, ripícola, ruderal (dos caminhos) e florestal (área envolvente). Foi realizado entre outubro de 2015 e maio de 2016, utilizando percursos pedestres já pré-definidos (PR1 e PR7).

Foram registados 170 taxa pertencentes a 133 géneros e 64 famílias. Elaborou-se um herbário, com todas os espécimes colhidos, e uma chave dicotómica ilustrada para a vegetação ripícola. Esta última inclui 79 taxa e respetivas fichas descritivas, com o intuito de produzir um guia de flora da Pateira de Fermentelos, que possa ser utilizado pelo público em geral e pelas instituições de ensino.

Os resultados revelam que existe uma grande diversidade florística, caraterística das comunidades vegetais identificadas, que urge conhecer e preservar.

keywords

Pateira de Fermentelos, Riparian vegetation, Dichotomous illustrate key,Descprition, Scientic divulgation.

abstract

Pateira de Fermentelos, located in the Aveiro region, is considered one of the largest natural freshwater lagoons of the Iberian Peninsula. This lagoon is an important aquatic and terrestrial ecosystem for the several European birds. It also plays a key role for local and regional population, who carry out numerous agricultural and recreation activities. Nowadays, duo to the industrial activities, the use of pesticides and herbicides in the agricultural crops, the lack of dredging and to the spread of invasive species, the ecological status of the lagoon has been deteriorating.

This dissertation intends to contribute to the knowledge and botanical conservation heritage and prospect it in terms of environmental education, by allowing its use as pedagogical and didactic resource. The floristic survey of Pateira de Fermentelos included the aquatic, riparian, ruderal (paths) and forest (surrounding area) habitats. It was performed between October 2015 and may of 2016, using the predefined walking routs (PR1 and PR7).

Were registered 170 taxa belonging to 133 genera and 64 families. An herbarium was prepared with all the species collected during the field trips as well as a dichotomous illustrate key to the riparian flora. This key comprises 79 taxa and their respective descriptive sheets in order to create a botanical field guide of Pateira de Fermentelos, that can be used by the public in general and for the educational institutions.

The results reveal the existence of a great floristic diversity, characteristic of the identified vegetal communities that is urgent to know and to preserve.

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List of abbreviation

AVE	*Herbarium Universitatis Aveirensis*
BRAHMS	Botanical Research and Herbarium Management System
CBD	Convention on Biological Diversity
COI	Herbarium of University of Coimbra
GPS	Global Position System
RNAP	National Network of Protected Areas
SIC	Sites of community importance
SNAC	National System of Classified Areas
ZPE	Special protected areas

1. Introduction

1.1. Environmental education

During the Convention on Biological Diversity (CBD) in 1993, the concept of biological diversity was defined as "*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*" (CBD 2016). Although biodiversity is essential to our planet, to human wellbeing and to the livelihood and cultural integrity of people, it is currently being lost at unprecedent rates due to human activities. Consequently the local and global diversity of the planet have being change due to this human effects on climate, biogeochemical cycles, land use and mobility of organisms(Baillie et al. 2004; Chapin et al. 2000).

In Portugal, which includes the Mediterranean, Atlantic and Macaronesia areas, exist a National System of classified areas (SNAC) that includes the National Network of Protected Areas (RNAP), the Classified Areas (part of Natura 2000 network) and others classified areas that are covered by the international commitments of the Portuguese state (ICNF 2016). This RNAP has classified 46 areas in continental Portugal, 10 areas in the Azores archipelago and 6 areas in Madeira archipelago. In addition, the Natura 2000 network classified in continental Portugal 96 Sites of Community Importance (SIC), 59 Special Protected Areas (ZPE) and 1 site that integrates the national list**.** As well as the Azores and Madeira archipelago includes 2 SIC, 15 ZPE and 23 special conservations areas and 9 SIC and 4 ZPE, respectively (ICNF 2016).

If on one hand the number of protected areas and directives have being increased, on the other hand it also having increases on the loss of environmental quality and human cultural and patrimonial values. This trend leads to the destruction of ecosystem balance and diversity, degradation of landscape and patrimonial richness and loss of quality of life in general (Morgado et al. 2000). So**,** it is necessary a change in the attitudes of citizens and the society in general that can be achieved through the environmental education.

Environmental education is a processes of the recognition of values and clarification of concepts that promotes the acquisition not only of knowledge and terms, but also skills, behaviour, and attitudes required to appreciate the relationship of the interdependence

between humanity, and their cultural environment and the natural environment (Pinto et al. 2010).

The environmental education is also an education about/in/to the environment and there should be a focus on the development of knowledge and comprehension of it, as well as being promoted in schools and in outdoor activities with the environment as an educational resource (Pinto et al. 2010). The use of environmental itineraries or circuits may be a pedagogical way to promote the learning of ecological compounds and also sensitize environmental preservation (Gomes 2002).

Usually, the environmental itineraries stimulate the development of educational processes, giving value to the local resources, and encouraging the participation of communities on the environmental valorisation (Santos e Guedes 1999).

Beyond this, it is also a typified for be a civic education; the education for citizenship and for developing notions of environmental values, social aspects, notions of civic duty, and responsibility to the environment. Despite the efforts of this education, the international and state intervention in the identification of problems and environmental awareness, the change of attitude and behaviour towards environmental issues has been a punctual and slow process (Pinto et al. 2010).

1.2. Environmental Education and Botany

Apparently there does seems to exist a natural affinity for the interest and study of animals when compared to study of plants, which results in the poor understanding and attitude toward the latter (Wandersee & Schussler 2001). To stress this idea, Wandersee and Schussler had created a new term, “plant blindness”, defined as the lack of capacity to see or notice plants in the environment.

Although the role of plants for terrestrial ecosystems is of unquestionable importance since they support all the food webs due to their ability to undergo the process of photosynthesis and to produce organic compounds, their apparent inability to directly interact with humans, as well other living organisms, along with the apparent invisibility of their benefits place them on a lower tier in the type of public interest (Raven, P.H., et al 1985;Pereira et al. 2006).

If environmental education embraces other types of methods, such as bringing the students to outdoors, it may help to solve this recurring problem that is increasingly evident. Some schools have nearby urban parks or other natural areas, for example walking routes, that can possess value that was internationally recognised and these areas could have favourable characteristics to develop interdisciplinary educational activities and be useful to develop several activities and other skills (Pereira et al. 2006).

The use of urban parks or other natural areas for science teaching science and environmental education have some advantages, like the proximity to schools which save transportation time, alleviates logistical and economic constraints, and provides students with direct interaction of plant specimens in their natural environment and the possibility to develop aesthetic and effective feelings (Pereira et al. 2006). Moreover, the use of walking routes that are near of schools are an important tool for environmental education and awareness, as a literal first step to stimulate the learning and the observation of nature and promote the preservation of natural heritage (Frias et al. 2014).

1.3. Tools for learning botany

1.3.1. Herbarium

Saint Pierre (1870) defined a herbarium as a collection of dry plants, prepared and arranged to study and stressed that it is the most instructive "book of plants" (Saint Pierre *in* Neves & Rodrigues 1957). It can also be a dynamic collection of dry plants where one can constantly extract, use or add information about each species and add information about new species (BioRede 2016).

In addition, a herbarium is a scientific collection composed of dry and pressed vegetal specimens, collected from diverse ecosystems, fixed on cardboard sheets, identified, catalogued and arranged according to a precise Botanic Classification System (BioRede 2016; Mormul & Leandrini 2007).

This type of botanical collection allows the documentation of the floristic richness of a particular region and it is an important source of information about the distribution and botanical diversity. Furthermore, it can also be a way for the development of several studies about phytogeography, photochemistry, ecology, systematics, ethnobotany, conservation biology and paleobiology. Moreover monographs, acquisition of data, comparisons of information and elaboration of ecological strategies may be achieved with this type of botanical data (Mormul & Leandrini 2007; Funk 2003; Santiago 2015; BioRede 2016).

Besides that, a herbarium can be used for both formal and informal education, providing, respectively, material for teaching to all levels of the educational hierarchy, and providing courses to the public in genera (Santiago 2015; Mithen & Drummond 1988; Funk 2003).

To make an herbarium is necessary to follow same steps in order to monetize their utilization. There are two initial steps: preparing and organization.

1.3.1.1. Preparing

The preparing is the most extensive process comprising the followings steps:

1.3.1.1.1. Collection of specimens

In order to make a correct collection of plants, is required same specific material that can differ according the type of plant, soil and the locale where the collection is made. In general, the necessary material is a hoe (uproot the plant), a knife (collected woody parts of trees or scrubs), pruning shears (to cut branches of trees and scrubs), hang tags (identify the specimens with a collection number) and plastic bags of different sizes (to temporarily keep the specimens). Registering, on the notebook, the collection number, date, locality, name(s) of collector(s), habitat/ecology information and other notes (e.g., size of the plant, flower colour), and whenever possible the scientific and common names should be done on-site. Besides this, supplementary equipment may include field guide, magnifying glass, tweezers, maps, GPS (Global Position System) equipment and a photographic camera for photographic recording of the plants (Neves & Rodrigues 1957; BioRede 2016; Forest 1996; Pinho et al. 2003).

Coupled with the material above mentioned, during this process some care should be considered such as: 1) specimens collected should be in good condition (free of insect damage, rust or disease); 2) plant selection should have well-developed organs (leaves, fruits, roots, flowers, and other reproductive structures); 3) collection of the entire plant should be done whenever possible; 4) enough plant material from each species should be collected to fill two herbarium sheets (with exception for rare species or unique specimens)(Neves & Rodrigues 1957; Forest 1996).

1.3.1.1.2. Preparation of specimens

Specimen preparation must be done as soon as possible. When it is not possible, to do it immediately, the plants should be kept in a cool place (approx. 4 °C).

The specimens are placed in two layers, separated by absorbent paper (eg. newsprint) – 2 or 3 sheets – or special cardboard sheets used for aquatic flora and plants with spinose structures. During this process, the specimens are arranged carefully to avoid overlap, with

some leaves are turned over in order to observe both axadial and abaxial surfaces, some fruits pressed flat, and, if possible, with the flowers opened to show the largest number of elements. Finally, the prepared specimens should be placed in a pressing frame for proper drying (Neves & Rodrigues 1957; BioRede 2016; Forest 1996; Pinho et al. 2003).

1.3.1.1.3. Drying

Drying, which may be achieved either naturally or artificially way, is a crucial step in the preservation of the material. The press must be placed in a sunny, dry, and ventilated locale where the temperature should range between 30 to 40°C. The newsprint and cardboard must be changed every day, at the beginning of the process, until complete desiccation of the specimens (BioRede 2016; Forest 1996; Pinho et al. 2003).

1.3.1.1.4. Processing of specimens

Once the preparation of specimens is finished, so starts the herbarium organization which involves the taxonomic study, and the definitive labelling, mounting, storage and maintenance (Neves & Rodrigues 1957; Forest 1996).

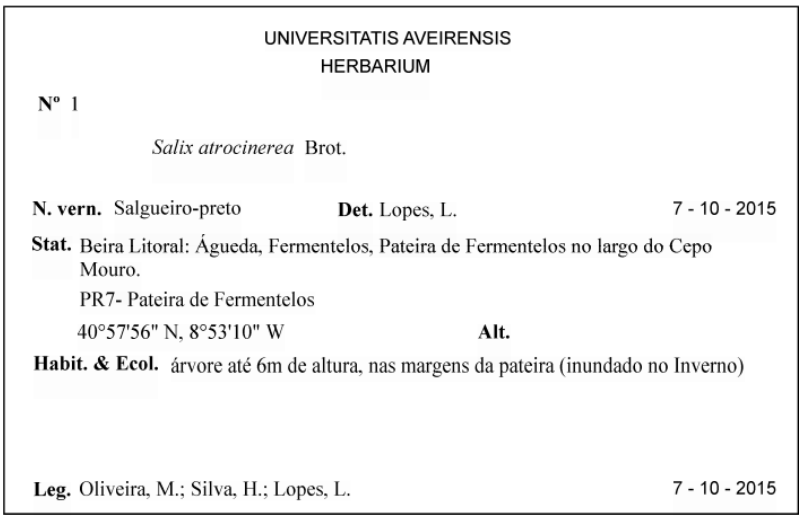
1.3.1.1.5. Taxonomic study and definitive label

Taxonomic study for an herbarium collection is based on the characteristics observed in the specimens in order to determinate the family, genus and species/subspecies for each plant.

The necessary materials for identification are flora books, taxonomic keys, monographic studies, and/or others taxonomic manuscripts, a stereo microscope and dissecting material. In order to assist in identification, it is suggested to dissect fresh material or, when it not possible, thoroughly moistened dry material. It is advise to try to have more than one sample of a species available to dissect and to double-check all identifications (Neves & Rodrigues 1957; Forest 1996; BioRede 2016).

After this processes, the definitive label is made using a computer software that will specify the herbarium name, collection number, scientific name, the common name, the date and name of the person who identified the specimen (DET.), place of collection (STAT.

- province, district, and others indications about the place of collection), GPS coordinates, the name(s) of collector(s) (LEG.) and the collection date (Figure 1) (Neves & Rodrigues 1957; Forest 1996; BioRede 2016).


UNIVERSITATIS AVEIRENSIS
HERBARIUM

Nº 1

Salix atrocinerea Brot.

N. vern. Salgueiro-preto **Det.** Lopes, L. 7 - 10 - 2015

Stat. Beira Litoral: Águeda, Fermentelos, Pateira de Fermentelos no largo do Cepo Mouro.

PR7- Pateira de Fermentelos

40°57'56" N, 8°53'10" W **Alt.**

Habit. & Ecol. árvore até 6m de altura, nas margens da pateira (inundado no Inverno)

Leg. Oliveira, M.; Silva, H.; Lopes, L. 7 - 10 - 2015

Figure 1. Definitive identification label of a sheet herbarium from Pateira de Fermentelos (Herbarium of Aveiro University-AVE).

1.3.1.1.6. Mounting

In this stage the specimens are fixed to a white cardboard sheet with ca. 28 x 44 cm. Space should be left in the lower left corner, to put the definitive identification label. The same portions of flowers, seeds, leaves, fruits or others elements should be stored in a Kraft coin envelope and fixed in the upper right corner. The mounting techniques applied can be variable but it is suggested the used of white adhesive tape at several points in order to affix the plant specimen (Neves & Rodrigues 1957; Forest 1996; BioRede 2016).

1.3.1.2. Storage and conservation of specimens

After these steps, processes the herbarium sheets are kept in paper folders, protected by paper sheets folded in the middle and stored in appropriate wardrobes by a systematic order. The herbarium specimens must be preserved from the moisture, light, predators and dust penetration. Periodically, the herbarium should be submitted to disinfection to kill detritivores namely insects (Neves & Rodrigues 1957; BioRede 2016).

1.3.2. Illustrated/interactive dichotomous keys

The traditional concept of a dichotomous key consists in a selection between two choices in a predetermined series of steps that will direct the user to a further question or to the name of the taxa (Ohkawa 2000; Osborne 1963). In illustrated dichotomous keys and interactive keys this concept is maintained but some illustrations or images are added that will help the user to identify the characteristic presented, facilitating identification. These type of keys are used for several reasons, from researchers testing the improvement of plants identification by students, to use by children and people in general, for environmental education, or just to give a tool to anyone to identify plants.

In order to explore the potential of the Fontelo Park for science and environmental education teaching, and to help basic school teachers to plan practical learning approaches, Pereira et al. (2006) created illustrated dichotomous keys to identify the main species found in this urban park. According to these authors, such activities helped students to understand and meet the wide variety of plants in the park. Also, they suggested that this kind of activity may be considered in the future as a first step to introduce these taxonomic instruments, and to pursue more complex practical activities that involves the construction of dichotomous keys.

The lack of interest in learning botany by undergraduate students, motivated Silva et al. (2010) to create an interactive illustrated dichotomous key available online (www.biorede.pt) for 390 taxa of vascular plants from the Baixo Vouga Lagunar region (Aveiro lagoon, Portugal). This interactive tool is an alternative to the conventional dichotomous keys to help teach botany in schools and universities. The results obtained, after testing the effectiveness of this tool, suggest that this key is an efficient multimedia tool in the teaching of botany that can increase the motivation of students and teachers to study and teach plant science, respectively.

The urban park of the city of Aveiro, (Parque Infante D. Pedro) is a privileged space for teaching botany and environmental education due to the high diversity of trees and shrubs, (both indigenous and exotic), and its proximity to the University of Aveiro and several other schools, namely secondary schools. Taking this into account, Nimis et al. (2012) elaborated,

in collaboration with the European project KeyToNaure and the Biology Department of University of Aveiro, an interactive and illustrated key to woody plants of this park, which is also available online. With this tool, the success of teaching botany and environmental education will be greatly improved due to the pedagogical nature and wealth of its photographic record (Nimis et al. 2012).

Wilson & Flory (2012) created an online interactive plant key, with the specific aim of improving student learning of botanical vocabulary, plant morphology and plant families. They suggest that this online tool can be used nationwide to supplement in-person laboratory courses or distance education classes in horticulture, botany, systematics and biology (Wilson & Flory 2012).

2. The freshwater lagoon Pateira de Fermentelos

Localized in the Aveiro region, Pateira de Fermentelos and its surrounding area is one of the largest natural freshwater lagoons of the Iberian Peninsula. The lagoon has an area of 5.29 km^2 which varies seasonally, reaching a maximum of 9 Km^2 at the wet season and the dry season it may decrease to 3 km^2, and an average depth of 2 m (Laranjeira & Nadais 2008; Sena 2007).

This natural freshwater lagoon is an important aquatic and terrestrial ecosystem to local, regional and European birds and also supports local and regional human populations. Besides that, many people practice fishing as a sport on its shores , canoeing, birdwatching and walking tours are popular due to the creation of walking routs around the lagoon (Laranjeira & Nadais 2008).

In the last decades, the drastic change in the dominant flora, the decline in collecting and dredging aquatic plants, the increased use of chemical fertilisers and pesticides, the domestic sewage, as well as, heavy metals sewage from industries, have all contributed in the rise of water pollution, resulting in eutrophication and consequently in the degradation of water quality (Bola 2009; Maria et al. 2006). In the same way, the pollution caused by urban and non-urban wastewater discharges along the Cértima's main course contributed significantly to the eutrophication risk of the Pateira de Fermentelos (Ferreira et al. 2010). This eutrophication created conditions facilitating the development of aquatic exotic species like the water hyacinth (*Eichhornia crassipes*) and the watermilfoil (*Myriophyllum aquaticum*) (Bola 2009).

The presence of these exotic species, namely *Eichhornia crassipes,* has been detrimental to these type of activities as well as to the tourism, recreation, and agricultural activities (Calado & Craveiro 1995; Laranjeira & Nadais 2008). The first observations of water hyacinth in Pateira de Fermentelos was in the 1990s, and in 2006 this invasive alien plant covered more than 50% of the lagoon surface, becoming a threat to the natural equilibrium of this ecosystem and to biological and hydrological cycles (Laranjeira & Nadais 2008). In order to eliminate this invasive plant species, it has been used an aquatic-harvester

machine dab been used between December 2006 and March 2007, which allowed the elimination of extensive mats of *Eichhornia crassipes*. (Laranjeira & Nadais 2008).Due to the effectiveness of this method, nowadays it still be implemented on Pateira de Fermentelos.

2.1. Location

Pateira de Fermentlos is located in the extreme west of the municipality of Águeda, district of Aveiro delimited by Requeixo and Óis-da-ribeira on the north, Fermentelos, Rego and Perrães at the south, Espinhel and Gocha to the east and Carregal to the west, being 20 Km from Atlantic coast, between parallels 40º29' N and 40º36' N and the meridians 8º36' W and 8º28'W (Sena 2007) (Figure 2).

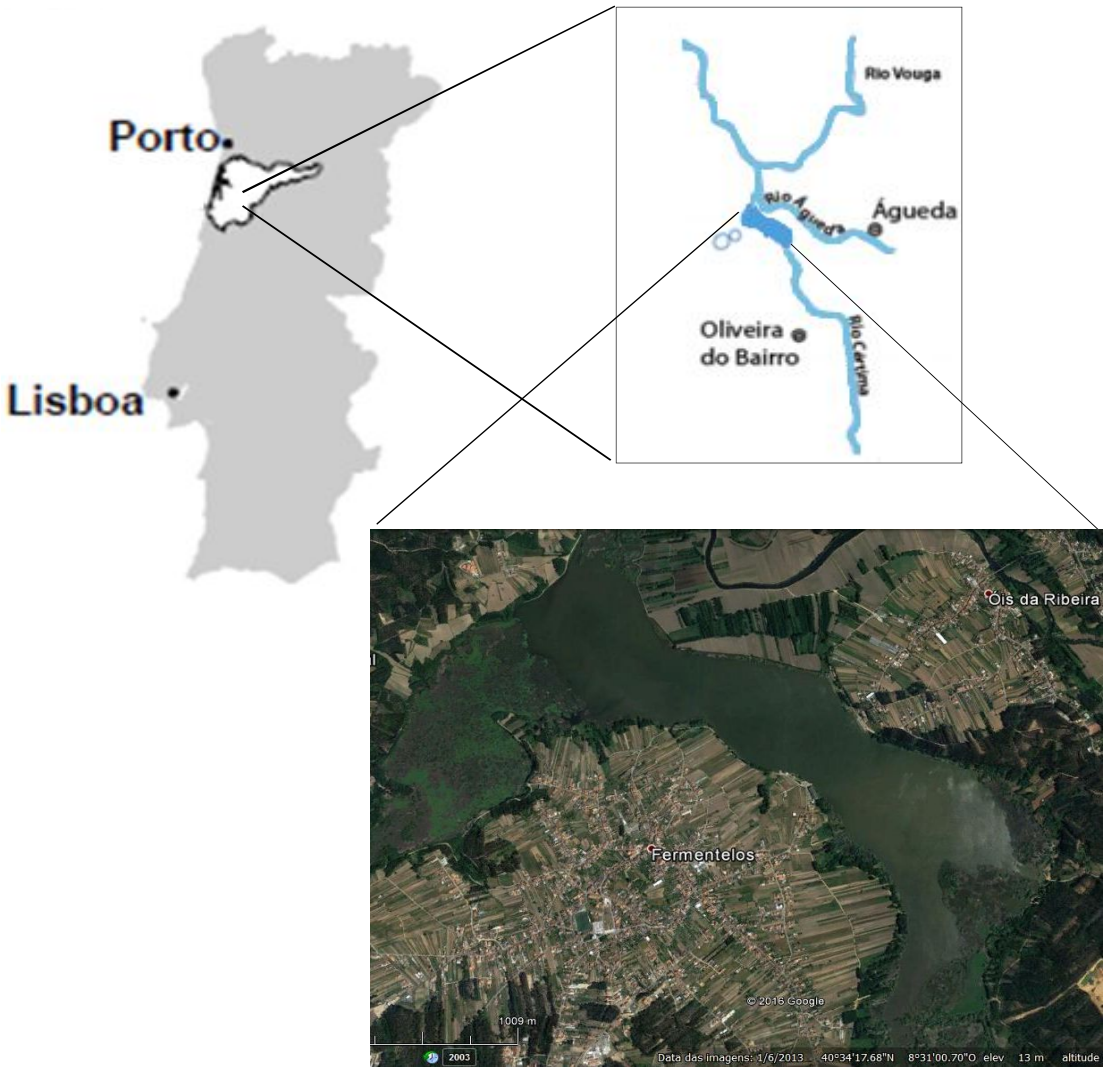


Figure 2. Location map of Pateira de Fermentelos (Adapted from Bola 2009 and Google Earth)

The lagoon is inserted into the downstream part of the Cértima River and is located immediately upstream the confluence between the Cértima River and the Águeda River (Sena & Melo 2012). This Cértima River, is a sub-basin of the Vouga river basin, the second largest river basin that is present in the Portuguese territory with a catchment that covers approximately 510 Km2 (Cerqueira et al. 2005; Laranjeira & Nadais 2008; Ferreira et al. 2010).

2.2. Ecological relevance

Being one of the largest natural freshwater lagoon on the Iberian Peninsula, Pateira de Fermentelos includes important aquatic and terrestrial ecosystems and as well as developed riparian and hyporheic zones therefore, this area is covered by different nature conservation legislation (Sena et al. 2012).

Having characteristics of a semi-lentic system, Pateira de Fermentelos is part of the Special Protection Area Ria de Aveiro (PTZE0004) of the Natura 2000 Network, being also protected by the Birds Directive (ICNF 2016; Ramsar 2013).

Due to the intense agricultural activity and inefficient urban and cattle wastewater treatment this extensive wetland was classified as a "sensitive area" by the Law Decree nº 152/97, which transposes to Portuguese law the European Directive 91/271/CEE concerning urban wastewater treatment (Cerqueira et al. 2005; Laranjeira & Nadais 2008). More recently, in 2012, the lagoon of Pateira de Fermentelos and the valleys of the rivers Águeda and Cértima were classified as RAMSAR Sites.

Furthermore, Pateira de Fermentelos has a rich floristic diversity composed by *Alnus glutinosa, Crataegus monogyna, Frangula alnus, Fraxinus angustifolia, Quercus robur, Phragmites australis, Scirpus lacustris, Typha* sp. and species with communitarian interest such *Ruscus aculeatus* (Habitats Directive – Annex V) and *Marsilea quadrifolia* (Habitat Directive-Annex II and IV)(Laranjeira & Nadais 2008). At the same time, it is also present rare and protected fauna, such *Lutra lutra* (Directive Habitats-Annex II and IV), *Vulpes vulpes, Oryctolagus cuniculus* the *Barbus bocagi* (Directive Habitats-Annex II),

Chondrostoma lusitanicum (Directive Habitats Annex-II) and *Rutilus alburnoides* (Directive Habitats Annex-II). The diversity of birds it is also evident: *Ixobrychus minutus, Ardea purpurea, Alcedo athis, Milvus migrans, Circus aeruginosus, Himantopus himantopus, and Sterna albifrons* (Directive 79/409/CEE Annex I)(Laranjeira & Nadais 2008).

2.3. Climate and geology

To the Vouga river basin is reported to be a moderately **Humid** climate, being characterized by moderate summers with moderate rainfall and accented winters with heavy rainfall. This area has an the annual average temperature of 13,9 °C with annual rain falls of 1300 mm with a relative humidity values between 70 and 86 % (ARHCentro 2013). As well as the Cértima catchment also has a **Mediterranean** clime with oceanic influences, being characterized with warm, dry summers and cool, wet winters (Cerqueira et al. 2005; Giorgi & Lionello 2007).

Being that the Pateira de Fermentelos is inserted in the Vouga river basin and on the Cértima catchment, this type of climate it is also present for these latter area. Therefore, based on the Gaussen Xerothermic Index, Alcoforado et al. (2009) characterize the zone of Pateira de Fermentelos between two types of climate for average temperatures >7º C in January: the **Mesomediterranean** attenuated (45 (±5) to 80 (±5) days biologically dry) and the **Sub-humid** (0 to 45 (±5) days biologically dry). Furthermore, the same authors characterize this region, in terms of Emberger Bioclimatic Levels, as **Humid** (average minimum temperature of the coldest month between 0° C to 3 °C) taking into account the total annual rainfall and the particular expression of the thermal regime.

Consequently, the type of climate of Pateira de Fermentelos has effects on the duration of the dry and wet periods, on the relative humidity and on the annual variation of insolation, with a wet season that goes from December to March and a dry season from June to September (Sena et al. 2012). Moreover, the relative humidity values of Pateira de Fermentelos, revealed a marked homogeneity along the year, with values between 75 to 80 %. In addition, the annual variation of insolation, the months with the most variation

are June through September, with and the lower variation is between December to February (Sena 2007).

Geologically, Pateira de Fermentelos is surrounded by sedimentary detrital rocks of Cretaceous age at west, north and south and rocks of the Triassic age at east. The Cértima river basin comprises Ordovician schists in the eastern, upper part of the catchment, and Modern-age alluvial sands and clays in its western, middle and lower parts (Cerqueira et al. 2005; Sena 2007; Ferreira et al. 2010).

2.4. Biogeography and Phytogeography

Biogeography is a branch of geography that studies the distribution of plants and animals on earth, having as its objective the establishment of one hierarchical typological model of the territory (Costa et al. 1998). It also tries to relate the physical environmental with the biological, and to do that it must include information from other sciences, such as geology, bioclimatology and phytosociology. More specifically, **Phytogeography** is concerned about the geographic distribution of plant species (Costa et al. 1998; Neto 2009).

Biogeographic territories are classified by categories in a hierarchical system. These are geographical spaces of a continuous surface which includes the orographic accidents and geological variations that may appear in the distribution area(Costa et al. 1998).

The principal division of biogeography are, in descending order, Kingdom, Region, Province, Sector, District and Tessela. With exception the Tessela, all the order categories can be grouped (Superdistrict, Superprovince) or subdivided (Subsector, Subprovince)(Costa et al. 1998).

According to the classification proposed by Costa et al. (1999), Pateira de Fermentelos is located between two climate regions of the Holartic **Kingdom**: the **Eurosiberian Region** (**Province**: Cantabro-Atlântica, **Sector** Galaico-Português, **SubSector**: Miniense) and the **Mediterranean Region** (**Province**: Gaditano-Onubo-Algarviense, **Sector**: Divisório Português and **SubSector**: Beirense Litoral) (Figure 3).

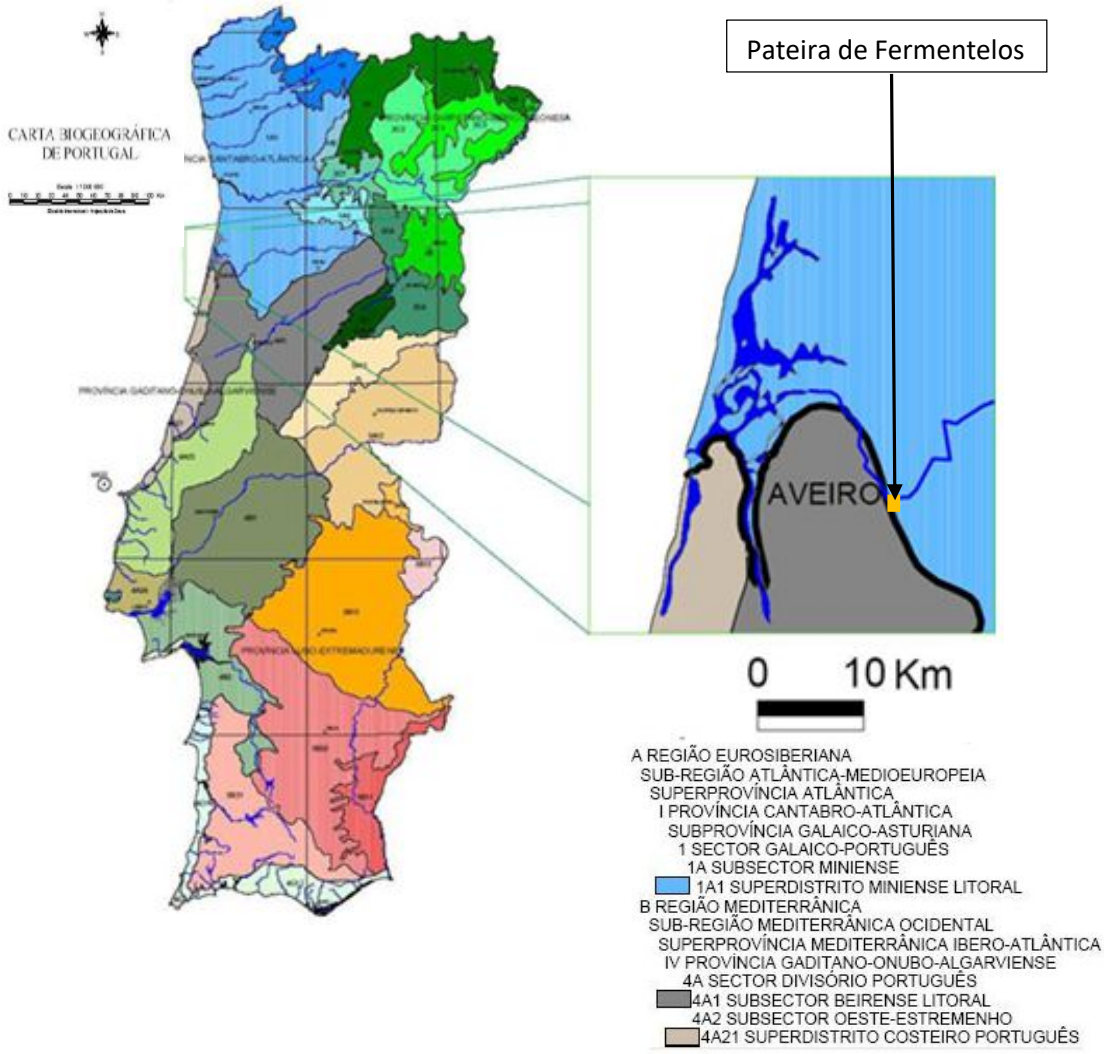


Figure 3. Biogeographical map of Portugal (continental area) with a Pateira de Fermentelos localization (Adapted from Costa et al. 1999).

The **Eurosiberian Region** is characterized by a null or very slight summer aridity, the summer rainfall compensating the evapotranspiration avowing the depletion of water reserves in the soils. The climate of the **Atlântica Superprovince**, which is part of the **Cantabro-Atlântica Province**, is strongly influenced by the mild effect of the Atlantic Ocean. In this Superprovince, the annual temperature range isn't very marked, the winter is not rigorous and the summer is not too hot. This type of climate allows the presence of *Quercus*

robur, Betula pubescens, Acer spp, *Ulex europaeus, Ulex minor, Erica ciliaris, Erica cinerea* and *Glandora prostrata*.

The **Galaico-Português** is the most southern **Sector,** having the greatest Mediterranean influence of the entire **Eurosiberian Region.** Various Mediterranean plants are present, such as *Daphne gnidium, Laurus nobilis, Ruscus aculeatus*, and *Smilax aspera,* even Atlantic species like *Pyrus cordata, Quercus robur, Ulex europaeus* subsp. *latebrateatus*. On the **Subsector Miniense,** that is located on the northwestern of the **Galaico-Português Sector**, the most common species are: *Carex durieui, Carex pilulifera, Centaurea limbata* subsp. *limbata, Ophioglossum lusitanicum, Salix arenaria, Sesamoides canescens* subsp. *suffruticosa, Trichomanes speciosum, Ulex europaeus* subsp. *latebracteatus,* and *Veronica montana*.

Comparatively, the **Mediterranean Region** is characterized as a climate with scarce rainfall in summer, although the occurrence of heavy rain may be present during the other seasons. In this region the species that frequently occur are: *Rhamnus alaternus, Laurus nobilis, Olea europaea* var. *sylvestris,* and *Quercus suber*.

The **Gaditano-Onubo-Algarviense Province** which extends from Ria de Aveiro to the sands of the Costa del Sol and to the sandstones of the Cadiz mountains of the Campo de Gibraltar, is very rich in paleomediterranean, paleotropical liane and lauroids with leathery leaves endemisms. Therefore, in this province it can be found such species as: *Myrica faia*, *Convolvulus fernandesii*, *Cheilantes guanchia*, *Polypodium macaronesium*, *Woodwardia radican*, *Acer* spp., deciduous *Quercus*, *Ilex*, *Inula*, *Sorbus*, some *Ericas*, and others species belonging to *Olea*, *Pistacia*, *Rhamnus*, *Myrtus* and *Asparagus*. Some of the endemic species on this province are *Erica umbellata*, can be found in Pateira de Fermentelos.

For the **Divisório Português Sector**, that extends from the Ria de Aveiro to the inland through the Mondego valley to the base of the Serra do Açor, the species that characterize bets this territory are: *Calendula suffruticosa subsp. lusitanica, Hyacintoides hispanica, Laurus nobilis, Leuzea longifolia, Quercus faginea subsp. broteroi, Quercus lusitanica, Scilla monophyllos, Serratula baetica subsp. lusitanica,* and *Serratula monardii* (Costa et al. 1998). The **Beirense Litoral Subsector** has some exclusive species such as *Erica cinerea, Halimium*

alyssoides, Halimium ocymoides, Pseudrrhremnatherum longifolium and other species like *Quercus robur,* and *Prunus lusitanica* (Costa et al. 1998).

3. Objectives

Taking into account the importance of botany in environmental education, the aim of this dissertation is the elaboration of illustrated tools for the identification of the flora of the wetland Pateira de Fermentelos, namely the riparian flora. These tools will be an effective help for learning botany along the walking routes of Pateira de Fermentelos. The specific objectives addressed in this thesis are the following:

1) Floristic survey of the Pateira de Fermentelos.

2) Elaboration of an herbarium of Pateira de Fermentelos flora.

3) Elaboration of an illustrated key for identification of riparian flora of Pateira de Fermentelos.

4) Contribution for a Botanic Field Guide of Pateira de Fermentelos.

4. Material and Methods

4.1. Taxa checklist elaboration

In order to characterize the flora of Pateira de Fermentelos, six field trips were performed along the surrounding walking routes during Autumn/Winter (October to November 2015) and Spring (March to May 2016). Those walking routes, that were made by the Águeda municipal council, are the **PR1- Trilho da Pateira ao Águeda** – a small route that passes through the territories of Óis da Ribeira and Espinhel parishes; and the **PR7 – Trilhos dos Poços** – a small route that belongs to Fermentelos parishes (Figure 4).

The checklist includes all the taxa observed during the field trips, with elements necessary for their taxonomic identification, as well as the *taxa* that were observed but not harvested. The collection and taxonomic identification of specimens was performed as described in the section 1.3.1 of the Introduction Chapter. In order to help on the identification of species/subspecies and to complement the dichotomous keys, a photographic register of the plant material was made.

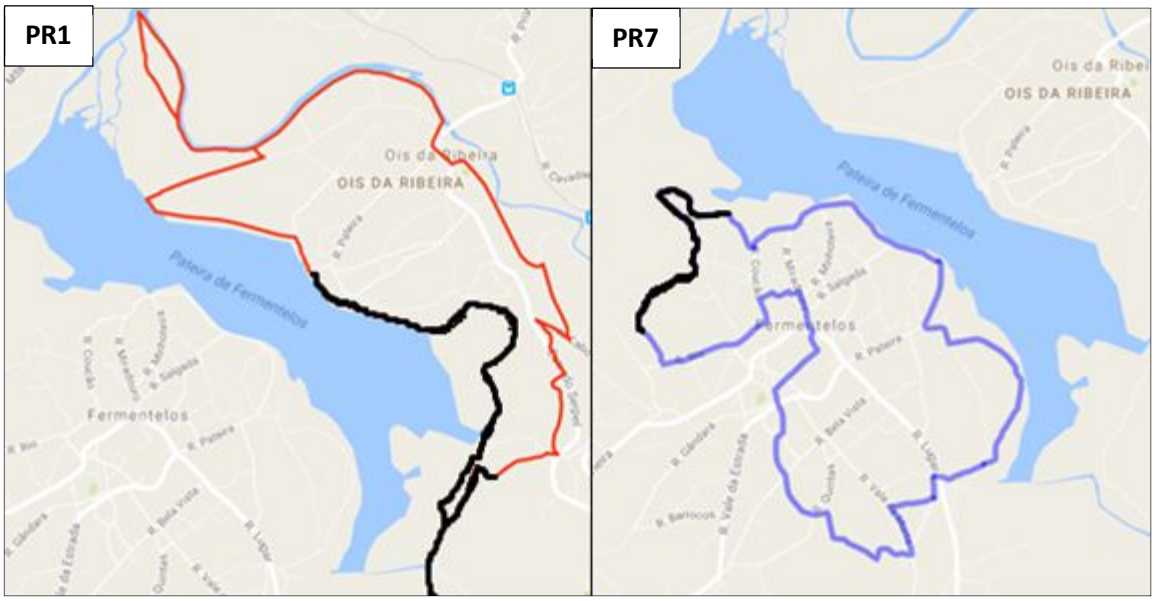


Figure 4. Walking routes of Pateira de Fermentelos. **PR7** – Trilhos dos Poços (black and lilac lines); **PR1** – Trilho da Pateira (black and red lines). The black lines correspond to the plants harvesting zones (Adapted from www.cm-agueda.pt).

4.2. Lifeforms characterization

In order to analyse the type of lifeforms that are present in the Pateira de Fermentelos, the biologic spectrum of Raunkiaer was used. This concept of a biologic spectrum, created by Raunkiaer (1934) as an expression of the phytoclimate of a particular region, allows the comparison of the flora between regions.

In this spectrum, five principal life-forms are considered: **Phanerophytes, Chamaephytes, Hemicryptophytes, Cryptophytes** and **Therophytes** (Figure 5). The classification of these lifeforms is based on the position of buds and their protection, during unfavourable periods of cold or heat (Table 1).

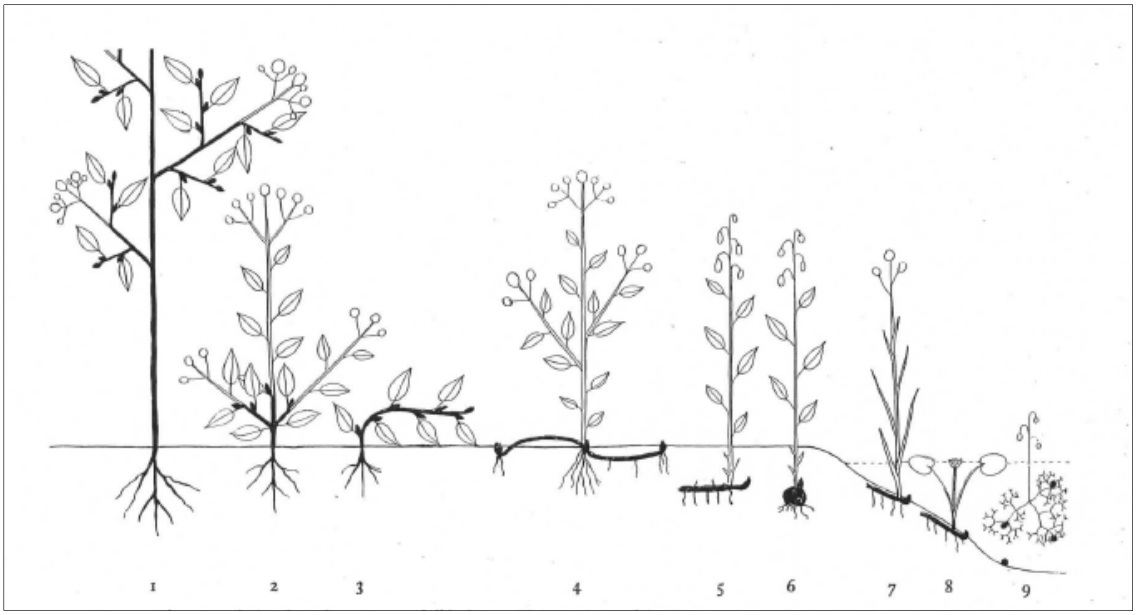


Figure 5. Diagram of four types of life-forms: 1-Phanerophytes; 2-3-Chamaephytes; 4-Hemicryptophytes; 5-9-Cryptophytes (5-6 – Geophytes; 7 – Helophytes and 8-9- Hydrophytes) (Adapted from Raunkiaer 1934).

Table 1 The principal life forms of plants in the classification system of Raunkiaer (1934).

Life forms	Definition
Phanerophytes	Plants whose buds and apical shoots, destined to survive during the unfavourable period of the year, project into the air on stems which live for several, often for many, years.
Chamaephytes	Plants whose buds or shoot-apices, destined to survive during the unfavourable season, are situated on shoots or portions of shoots which either lie on the surface of the soil or are situated quite near to it.
Hemicryptophytes	Plants whose the shoot-apices, destined to survive during the unfavourable season, are situated in the soil-surface, protected by the surrounding soil and by the withered remains of the plant itself.
Cryptophytes Plants whose buds or shoot-apices, destined to survive during the unfavourable season, are situated under surface of the ground, or at the bottom of water.	**Geophytes:** Land plant whose surviving buds or shoot-apices are borne on subterranean shoots at a distance from the surface of the ground.
	Helophytes: Plant which exclusively, or at any rate chiefly, grow in soil saturated with water, or in the water itself, from which the leaf- and flower-bearing shoots emerge.
	Hydrophytes: Plants whose survive during the unfavourable season by means of buds which lie at the bottom of the water; the vegetative shoots are sunk in the water, and only the flowers or the inflorescence rise above the surface for pollination.
Therophytes	Plants which survive during the unfavourable season in the form of seed (the protected state of all); they complete their entire life-history from seed to seed during the favourable season, and many of them can run through the whole cycle in as short a period as a few weeks.

4.3. Herbarium elaboration

After the collection of specimens (Figure 6), the herbarium elaboration was initiated following the steps described in Herbarium – Preparing (1.3.1.1) at the Introduction Chapter. Each collected specimen was assign a unique collection number which was registered, as well as information about the habitat and ecology. After this step, the specimens were arranged in folders to dry in a pressing frame (Figure 7) at the Herbarium facilities of the University of Aveiro.

Figure 6. Collection of specimens during the field trips.

Figure 7. A- Specimens arranged in folders; **B**- pressing frame used (Herbarium facilities in the University of Aveiro).

After desiccation, family, genus and species/subspecies was determined for each specimen collected. To this end, the resources Flora Iberica (www.floraiberica.es) and the Nova Flora de Portugal (Franco 1971;1984; Franco & Afonso 1994;1998; 2003) were used with the latter being for the taxa not yet described in Flora Iberica.

In order to manage the data to each specimen, the software **BRAHMS** - ***B**otanical **R**esearch and **H**erbarium **M**anagement **S**ystem*- (version 7.6) was used. This database allows the managing of herbarium collections, including elaboration of definitive labels of specimens, having begun to be developed in 1985 by the Department of Plant Sciences in University of Oxford, with the latest version (7.8) available at 5 October 2016 (BRAHMS 2016). After including all relevant information in the worksheet of BRAHMS, a definitive label was generated for each specimen (Figure 1).

The last steps included were the mounting, storage, and conservation of specimens. The specimens were fixed on to a white cardboard sheet with ca. 28 x 44 cm (Figure 8), kept in paper folders folded in the middle and stored, according to a systematic order, in appropriate wardrobes.

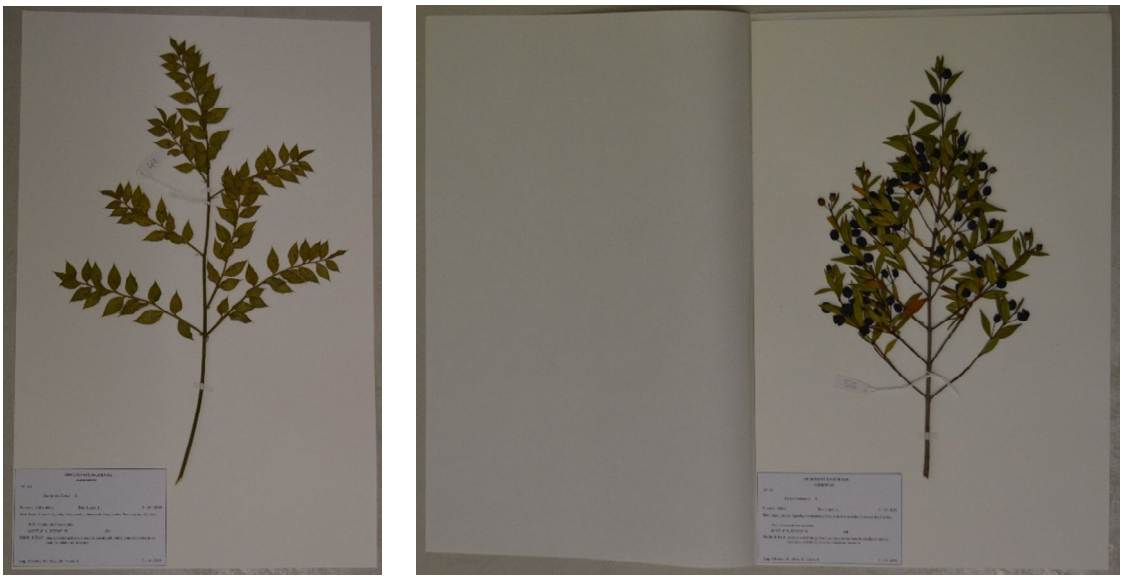


Figure 8. Specimens fixed on the white cardboard sheet with ca. 28 x 44 cm.

4.4. Contribution to the Botanical Field Guide

In order to promote environmental education, nature tourism and science teaching focused on the flora of the studied area, **Illustrated Identification Keys** and **Descriptive species sheets** were elaborated for the most representative taxa from of the riparian area of Pateira de Fermentelos. These contributions will be incorporated in a future Field Guide about the flora and vegetation of Pateira de Fermentelos, in an English and Portuguese version.

The characteristics utilized to distinguish the taxa, in the elaboration of the **Illustrated Identification keys**, were evident elements easily seen and identified by the user, like the presence/absence of evident petals, colour and number of petals, habitat type (aquatic or terrestrial), consistency (woody plant or herbaceous), among others. With the objective to further facilitate the identification of the plants, the dichotomous keys were complemented with photographic/illustrative records.

The **Descriptive Species Sheets**, also based on Flora Iberica, Nova Flora de Portugal and Flora Europaea (Tutin et al. 1968;1972;1976;1980;1993), included the following information: scientific name, common name(s) (Rocha 1996; FloraOn), botanical description, habitat, localization (PR1 or PR7) and flowering period. The botanical description was simplified, whenever possible, to include only characteristics easily observed by the users.

5. Results and Discussion

5.1. Floristic checklist

In the study area 170 taxa were collected/registered (species/subspecies), belonging to 133 genera and 64 families (Annex I). This checklist was complemented by added information about the phonetics of the species/subspecies, Portuguese common name and habitat type. The taxa were organized by alphabetic order of the families, genera and species/subspecies, respectively.

In this checklist were identified nine invasive species referenced in the Portuguese Law Decree nº 565/99: *Acacia dealbata, Acacia longifolia, Conyza bonariensis, Datura stramonium*, *Eichhornia crassipes, Hakea sericea*, *Myriophyllum aquaticum, Robinia pseudoacacia* and *Tradescantia fluminensis*. The presence of alien species can be explained by habitat modification due to human practices and periods of floodplains with consequent landscape changes (Naiman & Decamps 1997; Hood & Naiman 2000).

Although, it was possible to identify three main Habitats – **Riparian**, **Forest** and **Ruderal –** these were very fragmented, probably as a consequence of human activities like as agriculture practices and extensive plantation of eucalyptus and pine trees. This great vegetation fragmentation allied to the massive proliferation of the invasive species, namely *E. crassipes*, did not allow the description and characterization of natural habitats at Pateira de Fermentelos.

5.2. Taxonomic spectrum

According to the taxonomic spectrum (Figure 9), the most representative families register in this study area are: **Compositae** - 7%, **Gramineae** and **Leguminosae** - 6%, **Labiatae** and **Rosaceae** - 5%, **Ericaceae** and **Salicaceae** - 4%, **Cyperaceae**, **Liliaceae** and **Scrophulariaceae** - 3%.

In addition, with a total of 20%, 10 families, are represented with 2%: Cistaceae, Convolvulaceae, Fagaceae, Papaveraceae, Umbelliferae, Caryophyllaceae, Cruciferae, Oleaceae, Polygonaceae and Ranunculaceae. The remaining families are represented with 1% on a total of 33% of the taxonomic spectrum.

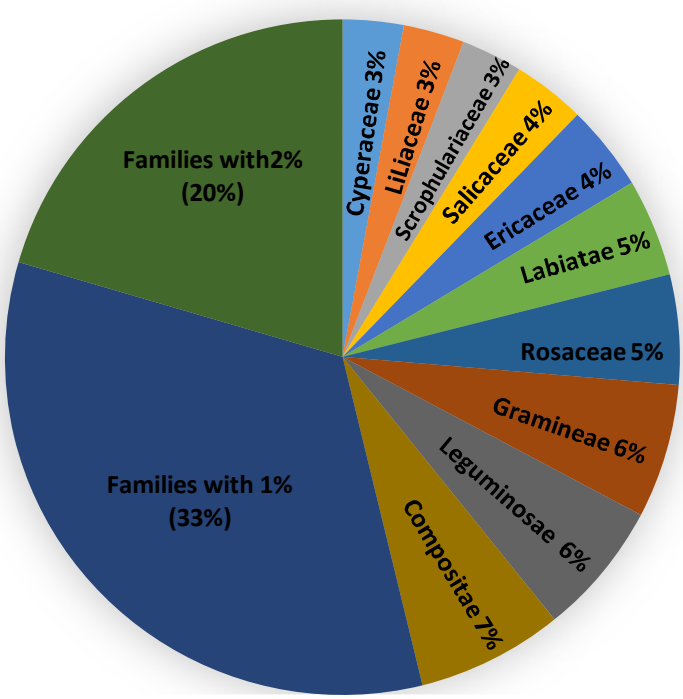


Figure 9. Taxonomic spectrum with the most representative families of Pateira de Fermentelos.

The presence of those families can be explained by the fact of Pateira de Fermentelos be characterised by agricultural activities and flooding events during the winter, influencing the type of vegetation, and also by the similarity with the biologic spectrum of the Portuguese Flora.

In fact, the three most representative families in the study area are, in descending order, Compositae, Gramineae and Leguminosae, with a total of 19% (Figure 9). According to Coutinho 1920, those same families are also the most representative among Portuguese flora, with a total of 28,7% although, the Leguminosae is more abundant than the Gramineae.

The same author refers the Scrophulariaceae and the Labiatae of the second group of families most abundant in Portuguese Flora being also of the most representative families of Pateira de Fermentelos. The Rosaceae, Liliaceae and Cyperaceae constitute the third group of the most abundant families of the Portuguese flora, just like in Pateira de Fermentelos, although with a different position order. These differences between Pateira de Fermentelos and Portuguese Flora may be related with the ecological specificities of the small studied area when compared with the total of the Portuguese territory.

Furthermore, the presence of families, such as Rosaceae, Salicaceae, Ericaceae, Fagaceae, Ranunculaceae and Oleaceae can be explained by the existence of an interface zone between terrestrial and aquatic ecosystems – the riparian zone – since, those same families are also the main dominant woody flora of the riparian zones of the Mediterranean region (Gregory et al. 1991, Stella et al. 2013). Also, the type of land use practices such as orchards, vineyards, olive grove, irrigation crops and forest of *Pinus* and *Eucalyptus* as well as the forest area that surrounds Pateira de Fermentelos, which are characteristic in this region, can be an explanation for the presence of these families Fermentelos (Aguiar et al. 2007).

5.3. Biologic Spectrum

The biological lifeforms spectrum allows the comparison of the flora between regions and vary according to the climate zone in study.

At Pateira de Fermentelos the most representative lifeforms are the **Phanerophytes** (29 %) following by the **Hemicryptophytes** (26%) and the **Therophytes** (22%). The other four lifeforms have a lower percentage, the Geophytes with 9%, the Helophytes with 8%, the Chamaephytes with 4%, and the Hydrophytes with 3% (Figure 10).

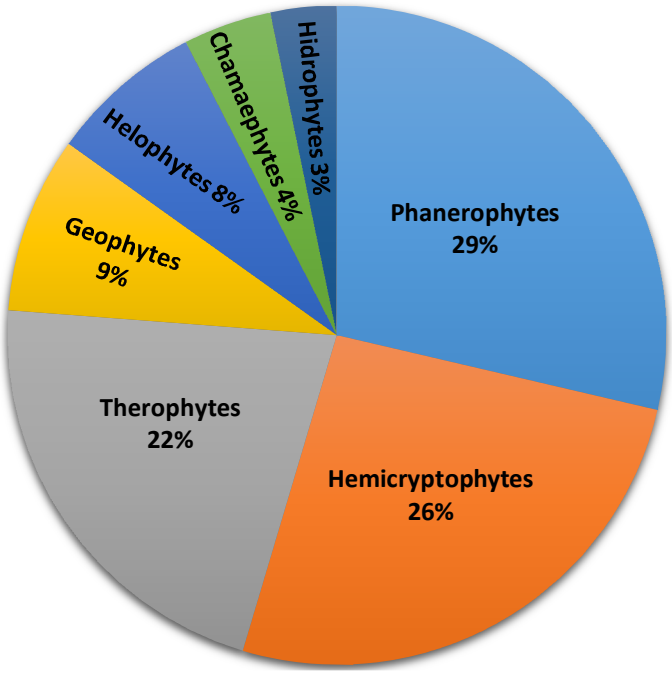


Figure 10. Biologic spectrum of the studied area of Pateira de Fermentelos.

This high percentage of **Phanerophytes** is probably due to the presence of deep soils and high water availability along the water lines, where riparian species such as *Populus nigra*, *Salix alba*, *Salix atrocinerea*, *Salix babylonica*, *Salix viminalis*, *Fraxinus angustifolia*, *Alnus glutinosa*, *Laurus nobilis* are dominant in the tree strata. In dryer soils, inside the forest, the community is characterized by other species that are reported to the Atlantic region, for example the phanerophytes *Pinus pinaster and Quercus robur,* and the chamaephytes *Ulex europaeus, Ulex minor, Erica ciliaris, Erica cinerea* and *Glandora*

prostrata (Costa et al. 1998; Stella et al. 2013). Moreover, the lower percentage of **Chamaephytes** wasn't expected since this life-form characterizes the Mediterranean communities. This lower percentage is probably due to the environmental variability on this study area.

This high heterogeneity in environmental conditions allows a high variability in the plant community composition; on the one had there are areas with high dominance of phanerophytes, along the water lines (riparian habitats), some forested areas with phanerophytes and some chamaephytes (forest) and other more disturbed areas with dominance of therophytes, characteristic to pioneer stages of plant succession (ruderal habitats) (Mor, 1997).

This percentage of **Therophtes** (22%) can be explained by the existence of management and anthropogenic disturbance features such as paths, roads and annual meadows. These landscape features are rich in annual species such as *Tolpis barbata*, *Briza maxima*, *Galactites tomentosus, Sonchus oleraceus, Trifolium angustifolium, Lavatera cretica, Coleostephus myconis* and *Echium plantagineum*. The high percentage of ruderal species, characteristic from initial stages of plant succession can also be explained by the degree of environmental degradation in the surrounding of Pateira de Fermentelos (BioRede 2016; Mor, 1997, Pinho et al.2003).

Additionally, the **Hemycryptophytes** and **Cryptophytes** (which correspond to the sum of geophytes (such as: *Ranunculus bulbosos, ranunculus ficaria, Narcissus bulbocodium, Oenanthe crocata, Pteridium aquilinum,* and *Schoenoplectus lacustris*), helophytes (such as: *Typha latifolia, Limniris pseudacorus, Phragmites australis, Carex pseudocyperus,* and *Hydrocotyle vulgaris*) and hydrophytes (such as: *Callitriche stagnalis, Myriophyllum aquaticum,* and *Nymphaea alba*)**,** have a total percentage of 46%, and this can be explained by the broad ecological spectrum. (Ribeiro 2000). Being plant species that stay dormant in the soil for many years, these groups present are present from the riparian to the ruderal habitats (Mor, 1997).

5.4. Conservation status

The importance of Natural Habitats is related with the need to preserve its fauna and flora. The Habitat Directive (Directive 92/43/CEE of the Natura 2000 Network) is directed to the preservation of natural habitats and wild fauna and flora with the aims to promote the maintenance of biodiversity through the conservation or restoration of the natural habitats and wild fauna and flora achieving favourable conservation status, taking in account economic, social, cultural and regional requirements. In the Annex Directive are listed over 1000 animal and plant species as well as 200 habitat types in need of protection, with each subsection of the annex addressing a different purpose. Annex II are applied to animals and plants species of community interest whose conservation requires the designation of special areas of conservation. On the other hand, the annex IV, which includes many species of the annex II, applies to a strict protection regime across their entire natural range within the European Union, both within and outside Natural 2000 sites. Lastly, the annex V are including animals and plants species of community interest whose taking in the wild and exploitation may be subject to management measures (Natura 2016).

At Pateira de Fermentelos, some species were identified that are protected by the above mention annexes such as: ***Narcissus bulbocodium*** and ***Ruscus aculeatus***. Although, during the field trips ***Marsilea quadrifolia*** wasn´t observed, there are Herbarium records (AVE and COI) demonstrating its presence to this area (Table 2). Beside those and considering the new proposal for the **Red List of Vascular Portuguese Flora**, it is possible to highlight ***Lycnhis flos-cuculi*** and ***Myosoton aquaticum*** as species with high conservationist relevance due to the existence of few populations or few individuals (SPB, 2016).

On the other hand, the human activities that are developed in the Cértima River like wine production (13% of the soil occupation), agriculture (30% of soil occupation), electroplating and ceramic industries (2% of soil occupation) and also in Pateira de Fermentelos (mostly agriculture), are leading to the deterioration and fragmentation of habitats as well as the degradation of water quality (Sena 2012). These type of activities will promote the presence of invasive/exotic species since they can be positively related

to direct human disturbances, within the river systems, and with floodplain uses such as urban occupation and intensive agriculture and nutrients inputs, with the consequence of decreasing of the number of endemic species (Aguiar et al. 2007).

Table 2 Species observed on the study area (Pateira de Fermentelos) with conservation status.

Family	Species	Document
Amaryllidaceae	*Narcissus bulbocodium* L.	Habitat Directive - Annex V
Caryophyllaceae	*Lycnhis flos-cuculi* L.	Proposal for the Red List of Vascular Portuguese Flora
	Myosoton aquaticum (L.) Moench.	Proposal for the Red List of Vascular Portuguese Flora
Liliaceae	*Ruscus aculeatus* L.	Habitat Directive - Annex V
Marsileaceae	*Marsilea quadrifolia* L.	Habitat Directive – Annex II and IV

5.5. Herbarium collection

Following the herbarium elaboration steps, (sections 1.3.1.1 and 4.2), it was possible to draw up the herbarium collection which is held at the *Herbarium Universitatis Aveirensis* (AVE). This collection is composed of 138 specimens corresponding to a total of 109 taxa belonging to 56 families. All the specimens, after the taxonomic identification, were fixed on white cardboard sheet with a surface area of 28 x 44 cm (Figure 8). A total of 167 duplicates were kept in craft paper. These herbarium specimens allowed to implement the AVE collections to provide material for teaching and to investigation

5.6. Contribution to the Botanical Field Guide

This Field Guide will contribute to the divulgation of Pateira de Fermentelos flora and vegetation, including the threat and control measures for the listed invasive plants and the conservation status for those threatened taxa. In addition to an introductory chapter about the importance and conservation relevance of Natural Habitats, this Guide will include **Dichotomous Illustrated Keys** and **Illustrated Descriptive Species Sheets** in order to allow the divulgation of the flora and vegetation of Pateira de Fermentelos to the general public.

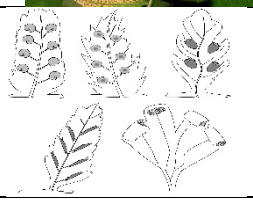
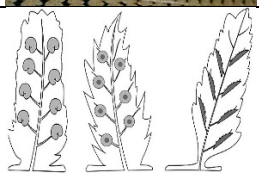
5.6.1. Dichotomous illustrated keys

Duet to the extensive floristic checklist of the study area which includes riparian, forest and ruderal habitats, the dichotomous illustrated key only include the species observed in the riparian habitat, the most representative of this freshwater lagoon.

Therefore, the dichotomous illustrated keys incorporate 79 *taxa* from the riparian habitat that were divided into three general groups: **ferns, plants with evident flowers** and **plants without evident flowers**. Since the group of plants with evident flowers contained the largest number of species, it was necessary to separate them into three groups: lilac/violet flowers; white/whitish to pink flowers; and yellow flowers.

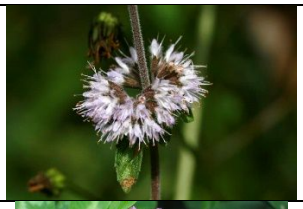
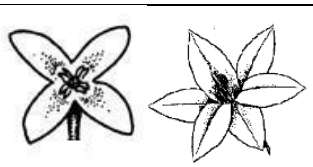
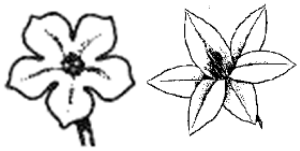
In order to elaborated this key, simple criteria were adopted that would be easily observed by the user, such as: presence or absence of evident flowers, flower colour, type of habitat (aquatic or terrestrial), type of plant (tree, shrub, herb), number of petals, leaf shape, among others characters. Furthermore, photos, which were mainly supplied by Lísia Lopes, and illustrations, which are mainly from the Biorede, were also added along the keys in order to help the user in their identification. In addition, this type of illustrated key can be easily updated with photos, illustrations, or even with the incorporation of new taxa. The illustrated keys elaborated for the riparian flora of Pateira de Fermentelos are shown as follow:

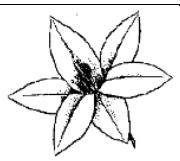
Ferns

1	Fertile portion (spores) in the apex of leaves	***Osmunda regalis***	
	Fertile portion (spores) not only in the apex of leaves	**2**	
2	Fertile portion (spores) on the leaf margin	***Pteridium aquilinum***	
	Fertile portion (spores) not as above	**3**	
3	Frond linear-lanceolate	***Asplenium trichomanes***	
	Frond not as above	**4**	
4	Frond usually up to 15 cm; ovate-oblong	***Anogramma leptophylla***	
	Frond above 15 cm; triangular-lanceolate	***Asplenium onopteris***	

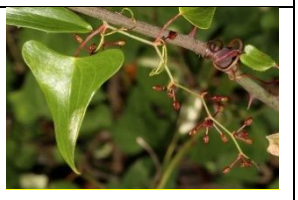
Plants with lilac/violet flowers

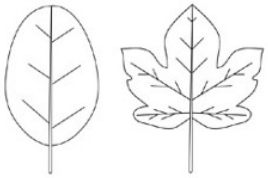
1	Aquatic plants	***Eichhornia crassipes***	
	Terrestrial plants	**2**	
2	Woody plants	***Erica ciliaris***	
	Herbaceous plants	**3**	
3	Flower(s) on the plant apex	**4**	
	Flowers arranged otherwise	**7**	
4	Solitary flower	***Viola riviniana***	
	Flower clusters	**5**	
5	Flower clusters with a spherical shape	**6**	
	Flowers not as above	***Prunella vulgaris***	

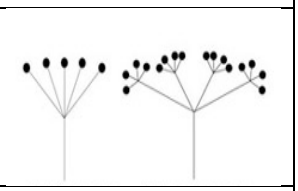
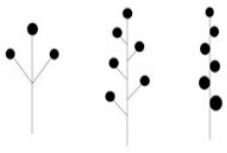
6	Simple leaves	***Mentha aquatica***	
	Compound leaves	***Trifolium pratense*** subsp. ***pratense***	
7	Flowers with 4 to 6 petals or lobes	**8**	
	Flowers not as above	**12**	
8	Flowers with 4 petals or lobes	**9**	
	Flowers with 5-6 petals or lobes	**10**	
9	Petals/lobes blue veined	***Veronica anagallis-aquatica*** subsp. ***anagallis-aquatica***	
	Petals/lobes not as above	***Cardamine pratensis***	
10	Petals 5	***Lychnis flos-cuculi*** subsp. ***flos-cuculi***	

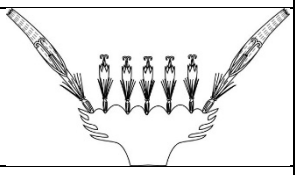
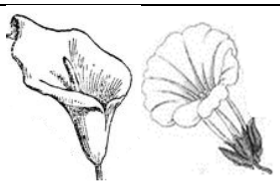
	Petals or lobes 6	**11**	
11	Solitary flowers in the axils of leaves	***Lythrum junceum***	
	Flowers clusters and terminal	***Lythrum salicaria***	
12	Campanulate corolla	***Digitalis purpurea***	
	Corolla not as above	***Lamium maculatum***	

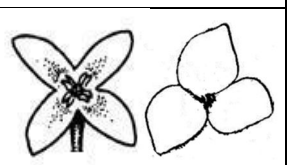
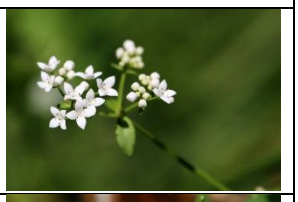
Plants with white/whitish to pink flowers

1	Plants without chlorophyll	***Cuscuta campestris***	
	Plants with chlorophyll	**2**	
2	Aquatic plants	***Nymphaea alba***	
	Terrestrial plants	**3**	
3	Woody plants	**4**	
	Herbaceous plants	**10**	
4	Climbing plants	**5**	
	Not climbing plants	**6**	
5	Stems prickly; Leaves alternate	***Smilax aspera***	

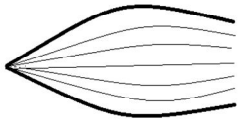
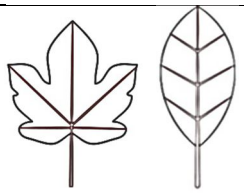
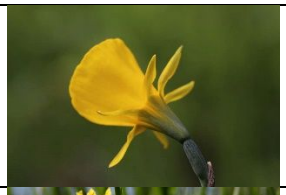
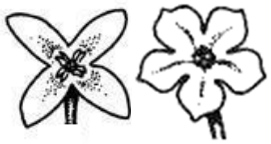
	Stems without spines; Leaves opposite	***Lonicera periclymenum***	
6	Compound leaves	**7**	
	Simple leaves	**8**	
7	Scrub; solitary flowers	***Rosa sempervirens***	
	Herbaceous plant; grouped flowers	***Trifolium repens***	
8	Entire leaf, sometimes with serrulate or undulate margin	**9**	
	Leaf not as above	***Crataegus monogyna***	
9	Leaf margin serrulate	***Pyrus cordata***	

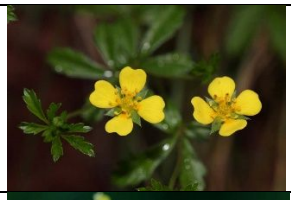
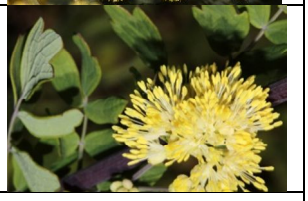
	Leaf margin entire or undulate	***Frangula alnus***	
10	Leaves all basal	***Alisma plantago-aquatica***	
	Leaves not as above	**11**	
11	Flowers grouped in umbel	**12**	
	Flowers not grouped in umbel	**13**	
12	Entire or serrulate leaves	***Angelica sylvestris***	
	Leaves deeply fissured	***Oenanthe crocata***	
13	Flowers grouped in a spike shape	**14**	
	Flowers not grouped in a spike shape	**15**	

14	Opposite and wrinkled leaves	***Mentha suavelens***	
	Alternate and not wrinkled leaves	***Polygonum hydropiper***	
15	Flowers grouped in a capitulum	**16**	
	Flowers not grouped in a capitulum	**17**	
16	Leaves all basal	***Bellis perennis***	
	Leaves not as above	***Aster squamatus***	
17	Flowers with funnelform or spathe	**18**	
	Flowers not as above	**19**	
18	Climbing plant; leaves along the stem	***Calystegia sepium***	

	Not climbing plant; leaves at the base	***Zantedeschia aethiopica***	
19	Flowers with 3-4 petals/lobes	**20**	
	Flowers not as above	***Myosoton aquaticum***	
20	Flowers with 3 petals/lobes	***Tradescantia fluminensis***	
	Flowers with 4 petals/lobes	**21**	
21	Axillary flowers	***Lycopus europeus***	
	Not axillary flowers	**22**	
22	Simple leaves	***Galium palustre***	
	Compound leaves	***Rorippa nasturtium-aquaticum***	

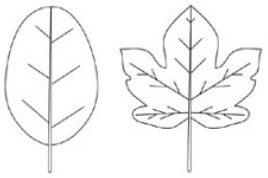
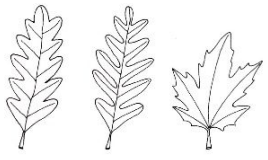
Plants with yellow flowers

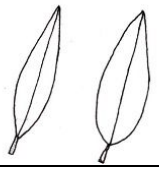
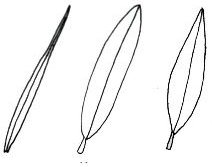
1	Leaves with parallel veins	**2**	
	Leaves not as above	**3**	
2	Solitary flowers	***Narcissus bulbocodium***	
	Flowers 2-12	***Limniris pseudacorus***	
3	Flowers with 4 to 5 petals/lobes	**4**	
	Flowers not as above	**8**	
4	Flowers with 4 petals	**5**	
	Flowers with 5 petals	**7**	

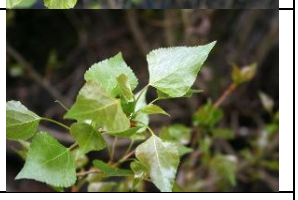
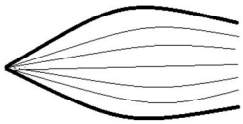
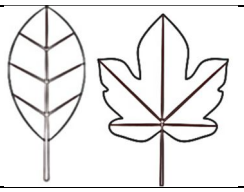
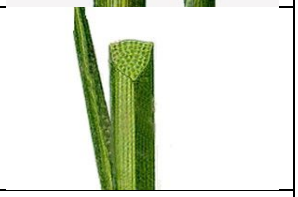
5	Palmatisect leaves	***Potentilla erecta***	
	Leaves not as above	***Rorippa amphibia***	
6	Leaves with entire margin	***Lysimachia vulgaris***	
	Leaves with indented margin	**7**	
7	Stoloniferous plant	***Ranunculus repens***	
	Not stoloniferous plant	***Ranunculus bulbosus*** subsp. ***bulbosus***	
8	Flowers grouped in a more or less globose shape	**9**	
	Flowers not as above	**10**	
9	Woody plant; tree or shrub	***Acacia dealbata***	
	Herbaceous plant; herb	***Thalictrum speciosissimum***	

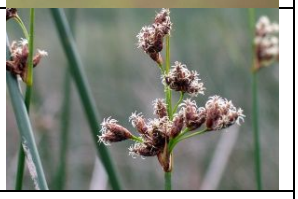
10	Leaf margin distinctly indented	***Parentucellia viscosa***	
	Leaf margin not distinctly indented	***Ranunculus ficaria***	

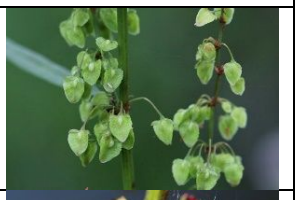
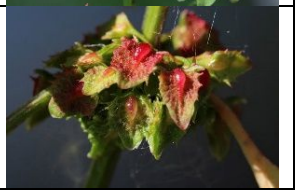
Plants with diminished or without evident flowers

1	Aquatic plants	**2**	
	Terrestrial plants	**3**	
2	Opposite leaves	***Callitriche stagnalis***	
	Verticillate leaves	***Myriophyllum aquaticum***	
3	Woody plants	**4**	
	Herbaceous plants	**13**	
4	Compound leaves	***Fraxinus angustifolia***	
	Simple leaves	**5**	
5	Leaves ± deeply indented	**6**	
	Leaves not as above	**7**	
6	Leaves with shortly hairs beneath; fruiting catkins	***Populus alba***	

	Leaves and fruits not as above	***Quercus robur***	
7	Lanceolate leaves	**8**	
	Leaves not as above	**12**	
8	Leaves lanceolate to linear-lanceolate	**9**	
	Leaves oblong-lanceolate	**11**	
9	Shrub or small tree up to 10 m	***Salix viminalis***	
	Tree up to 15-25 m	**10**	
10	Branches long, pendent, drooping almost to the ground	***Salix babylonica***	
	Braches not as above	***Salix alba***	
11	Flowers grouped in a spike shape	***Salix atrocinerea***	

	Flowers not as above	***Laurus nobilis***	
12	Leaves nearly rounded with tufts of yellowish hairs near de veins	***Alnus glutinosa***	
	Leaves not as above	***Populus nigra***	
13	Climbing plants	***Tamus communis***	
	Plants not as above	**14**	
14	Leaves with parallel veins	**15**	
	Leaves not as above	**23**	
15	Cylindrical stems	**16**	
	Trigonous stems (three-angled)	**20**	

16	Leaves reduced to sheath	***Juncus effusus***	
	Leaves not as above	**17**	
17	Leaves fleshy	***Typha latifolia***	
	Leaves not as above	**18**	
18	Fertile portion plume-like	***Phragmites australis***	
	Fertile portion not as above	**19**	
19	Inflorescence 5-40 cm, compact and spike-like	***Molinia caerulea***	
	Inflorescence 2-8.5 cm with an ovoid to ovoid-lanceolate shape	***Schenoplectus lacustris***	
20	Solitary stems	**21**	
	Not solitary stems	**22**	
21	Fertile portion straw-coloured or yellowish-red at maturity	***Cyperus eragrostis***	
	Fertile portion dark brown or reddish at maturity	***Cyperus longus***	

22	Leaves shorter than the stems	***Carex cuprina***	
	Leaves longer than the stems	***Carex pseudocyperus***	
23	Basal leaves hastate or triangular in shape	***Atriplex prostrata***	
	Leaves not as above	**24**	
24	Circular or subcircular leaves	***Hydrocotyly vulgare***	
	Leaves not as above	**25**	
25	Fruit valves oblong-ovate	***Rumex conglomeratus***	
	Fruit valve triangular-ovate	**26**	
26	Fruit valves entire or denticulate	***Rumex crispus***	
	Fruit valves usually with 1-2 teeth on each side	***Rumex obtusifolius***	

5.6.2 Descriptive Species Sheets

All the taxa included in the dichotomous keys have additional information compiled in a descriptive sheet. This description includes the scientific name, family, the botanical description, and information about the habitat, localization (PR1 or/and PR7) and flowering period. In order to simplify the use of the Guide, the botanical descriptions only include characteristics easily observable by the user and are complemented with photos/ illustrations and/or descriptions of some botanical terms. The information of each descriptive species sheet is shown as follow, by alphabetical order of taxa listed in each illustrated key:

Ferns

***Anogramma leptophylla* (L.) Link.**

Family: Hemionitidaceae

Botanical description: Small fern; Dimorphic leaves, the sterile with (2)3-7(9) cm, 1-2 pinnate, ovate to reniform, fertile leaves with (5)7-15(25) cm, 2-3 pinnate, ovate to oblong; Fertile portion (sori with spores) in the secondary nerves.

Habitat/Localization: Wet and shadow lands, cracks walls and cliffs. **PR1- Forest zone**

Flowering: March to November

***Asplenium onopteris* L.**

Family: Aspleniaceae

Botanical description: Fern with branched rhizome; Leaves 15-45 cm, lamina (5.5)9-25(30) x 5.5-17(20) cm, 3(4)-pinnate, triangular-lanceolate, dark green, leathery and bright on the upper surface; petiole brown-blackish to black purplish, bright in the upper portion; Fertile portion (sori with spores) on the proximity of nerves, oblong or linear.

Habitat/Localization: Wet and shadow lands of forests, cracks walls and cliffs. **PR1- Riparian zone**

Flowering: January to December

***Asplenium trichomanes* L.**

Family: Aspleniaceae

Botanical description: Fern with short rhizome; Leaves 4-20(35) cm, lamina 3.5-18(30) x 0.5-1.8 cm, 1-pinate, linear-lanceolate; Fertile portion (sori with spores) small, linear.

Habitat/Localization: Sub-cosmopolitan. **PR1 and PR7 – Riparian zone**

Flowering: January to December

***Osmunda regalis* L.**

Family: Osmundaceae

Botanical description: Fern with a short and stout rhizome, covered by persistent leaf-bases; Leaves with 30-150 cm in a dense crown (only the inner is fertile), not persistent, bi-pinnate; Fertile portion (sori with spores) only in the apex of leaves, replacing the green tissue, not occupying more than ¼ of the leaf; fertile pinnae pale green, quickly turning brown.

Habitat/Localization: Most common in wetlands, preferably acidic, like as riverbanks, small rivers, and woodlands. **PR1 - Riparian zone**

Flowering: March to September

Pteridium aquilinum* (L.) Kuhn** subsp. ***aquilinum

Family: Hypolepidaceae

Botanical description: Fern with a long and subterranean rhizome; Leaves with 40-400 cm, up to tri-pinnate, nearly triangular; Fertile portion (sori with spores) contiguous, on the marginal leaf vein, covered by the leaf margin and by the ciliate and brown indusium.

Habitat/Localization: Dark and acidic lands like pine forests, uncultivated or cultivated lands, forest edges**. PR1 and PR7 – Riparian zone**

Flowering: March to September

Plants with lilac/violet flowers

***Cardamine pratensis* L.**

Family: Cruciferae

Botanical description: Herbaceous plant; Stems 8-80 cm, glabrous; Basal leaves usually forming a rosette, with 3-30 cm, ovate to rounded or reniform; caulinar leaves, 2-17 cm; Flowers in groups of 3-45, with 4 petals, lilac; Fruit with 14-42 x 1-2 mm.

Habitat/Localization: Riverbanks, meadows, wet pastures, dark woods. **PR7 – Riparian zone**

Flowering: March to July

Digitalis purpurea* L.** subsp**. *purpurea

Family: Scrophulariaceae

Botanical description: Herb; Stems (20)50-100(150) cm with hairs; Basal leaves with 5-20 x 1.5-10 cm, ovate to elliptical; Flowers in grouped (15-100) with 15-60(120) cm; Flowers with a campanulate corolla, 30-48 mm, pink or purple; Fruit 9-15 x 6-10 mm, ovoid-oblong, pubescent.

Habitat/Localization: Rocky places, grassy slopes and open forests. **PR7- Riparian zone**

Flowering: May to August

***Eichhornia crassipes* (Mart.) Solms.**

Family: Pontederiaceae

Botanical description: Floating aquatic plant with a short and floating rhizome; Aerial leaves arising in tufts, lamina 2.5-14 x 3.5-9.5 (13) cm, somewhat rounded, petiole with 3.5-50 x 1.5-3 cm and inflated in the lower half; Flowers (4-8) grouped, violet-blue flowers, lobule 1.6-3.7 cm; Fruit 10-15 x 5-6 mm.

Habitat/Localization: Silts, sands or stagnant waters rich in nutrients (eutrophic). **PR1 and PR7 – Lagoon**

Flowering: June to November (December)

***Erica ciliaris* Loefl. ex L.**

Family: Ericaceae

Botanical description: Shrub with (0.1)0.2-0.8(1.8) m; Stems reddish-brown, hairy; Leaves 2-4(5) x 0.8-2(2.5) mm in whorls of 3-4, lanceolate or ovate, hairy; Flowers (6)8-10(13) mm long, tubular-urceolate, deep pink or purplish; Fruit with 2.2-3 mm, glabrous.

Habitat/Localization: Forest and moist and acid soils, sometimes sandy soils. **PR1 and PR7 – Forest zone**

Flowering: May to September (December)

***Lamium maculatum* L.**

Family: Labiatae

Botanical description: Herb with 18-50(82); Stems erect; Leaves with (1.5)3-6.5(9) x (12.5-5.5(6) cm, obcordate to ovate, margin irregularly serrate, green; Flowers in groups of (2)4-10(18) each one with 18-30 mm long, purple or pale pink; Fruit with 2.9-3.5(3.8) x 1.4-1.8 mm, brown.

Habitat/Localization: Moist woods, in water flow margins. **PR1- Riparian zone**

Flowering: February to October (December)

Lychnis flos-cuculi* L.** subsp**. *flos-cuculi

Family: Caryophyllaceae

Botanical description: Herb; Stems 20-70(90) cm, often branched; Leaves of the basal rosette 30-120 x 5-15 mm, oblong-spatulate; stem leaves, with 20-70 x 3-6 mm, linear-lanceolate; Flowers in groups of (2)5-8(16), with 5 petals, pink; Fruit 6-10 x 3-7 mm, ovoid-globose.

Habitat/Localization: Wet meadows and road berms. **PR7- Riparian zone**

Flowering: April to August

***Lythrum junceum* Banks & Sol.**

Family: Lythraceae

Botanical description: Herbaceous plant with 20-50(70) cm, branched from the based; Stems with a quadrangular section, glabrous; Leaves (7)12-17(30) x (1.5)3-6(11) mm, alternate, linear to oblong-elliptical; Solitary flowers in the leaf-axils, with 6 petals, pale violet or purple; Fruit cylindrical-ellipsoid.

Habitat/Localization: Wet pastures. **PR7- Riparian zone**

Flowering: (April) May to July (September)

***Lythrum salicaria* L.**

Family: Lythraceae

Botanical description: Herbaceous plant with (45)65-85(150) cm; Stems with quadrangular section, hairy; Leaves (30)40-60(90) x (6)10-15(20) mm, rarely opposite, linear to lanceolate; Flowers grouped in terminal clusters with up to 40 cm long, with 6 petals, violet-purple; Fruit ovoid.

Habitat/Localization: Soggy places and banks of watercourses. **PR7 – Riparian zone**

Flowering: (May) June to August (November)

***Mentha aquatica* L.**

Family: Labiatae

Botanical description: Herb with 19-50 cm; Stems up to 5 mm thick, pubescent at the top; Leaves 20-50(87) x 11-27(45) mm, ovate to orbicular, dentate or serrate, pubescent above and beneath; Flowers grouped in a spherical shape with 1.5-3 x 1.5-2.5 cm and terminal; Flowers 5.5-7 mm, lilac or purple; Fruit 1-1.1 x 0.6-0.8 mm, light brown.

Habitat/Localization: Clean water channels, lagoons, pastures and sometimes riverside woods. **PR7- Riparian zone**

Flowering: May to October (November)

***Prunella vulgaris* L.**

Family: Labiatae

Botanical description: Herb with 5-60 cm; Stems purple or brown, pubescent; Leaves 1.7-9.6 x 0.4-3.6 cm, ovate, triangular-ovate or elliptical, pubescent above and almost glabrous beneath, dark green above and light green beneath; Flowers grouped in a cylindrical shape with 1.3-7.5 x 1-1.5 cm; Flowers 11-12 mm, purple and white in the basal part; Fruit 2.2-2.3 x 0.9-1.1 mm, ellipsoid, light brown.

Habitat/Localization: Wet meadows, sometimes soaked. **PR1 -Riparian zone**

Flowering: April to November

Trifolium pratense* L.** subsp**. *pratense

Family: Leguminosae

Botanical description: Herb; Stems 6-110 cm, erect or ascending, glabrous; Compound leaves with 3 segment with 50 x 30 mm each, top leaves with elliptical or obovate segments, basal leaves usually with ovate or subrounded segments; Flowers grouped in a spherical shape with 17-40 x 16-33 mm; Flowers with 8.5-16 mm, pink to purplish;

Habitat/Localization: Pastures and meadows, moist soils. **PR1** and **PR7-Riparian zone**

Flowering: (February) April-October(November)

Veronica anagallis-aquatica* L.** subsp. ***anagallis-aquatica

Family: Scrophulariaceae

Botanical description: Herb; Stems 10-100(150) cm, erect or ascending, glabrous; Leaves 15-170 x (7)8-40 mm, entire, with dentate or serrate margin, basal leaves ovate or oblong, upper and medium leaves oblong-lanceolate; Flowers (20-100) in opposite groups up to 25 cm, 4 petals with 4-9 mm diameter, blue or lilac with dark blue veins; Fruit 2-4(5) x 2-3.5(4) mm, ovoid to subspherical.

Habitat/Localization: Margin of watercourses, water sources and flooded places in general. **PR1-Riparian zone**

Flowering: March to December

Viola riviniana **Rchb.**

Family: Violaceae

Botanical description: Herbaceous plant with a rosette of basal leaves, from which appear the floral stems with 25-30(40) cm; Leaves subrounded; Solitary flowers violet coloured; Fruit 8-10 x 4.5-6.5 mm.

Habitat/Localization: Low dense forests, herbaceous margins of forests and pastures. **PR1 – Riparian zone**

Flowering: (December) January to July

Plants with white/whitish to pink flowers

***Alisma plantago-aquatica* L.**

Family: Alismataceae

Botanical description: Aquatic or amphibious plant with 20 -120 cm; Basal leaves (8)10-50(100) cm generally ovate, petiole 8-70 cm; Terminal flowers in groups of 4-9(11), white or purplish-white; Fruit with 2-2.3(2.5) x 1.2-1.8 mm.

Habitat/Localization: Wet areas like lagoons, riverside and water courses. **PR1 -Riparian zone**

Flowering: (May)June to October

***Angelica sylvestris* L.**

Family: Umbelliferae

Botanical description: Herb; Stems with 50-200(300) cm and 2.7 cm in diameter, striated; Basal leaves 2-3-pinatisect and lower leaves normally ovate; Flowers are grouped in the rays (until 75), with white to pinkish or purplish colour; Fruits 3-7(8) x 2-4 (6.5) mm, with elliptical shape, dark or brown.

Habitat/Localization: Wetlands. **PR1- Riparian zone**

Flowering: July to October

***Aster squamatus* (Sprengel) Hieron.**

Family: Compositae

Botanical description: Herbaceous plant with 30-100 cm; Stems erect or ascending; Leaves with 4-18 x 0.5-1.5cm, entire, linear or linear-lanceolate; Flowers grouped in capitula, marginal flowers white-purplish. The fruits are oblong.

Habitat/Localization: Ruderal sites with soil moisture, abandoned gardens, crops and disturbed environments. **PR1 and PR7 – Riparian zone**

Flowering: May to September

***Bellis perennis* L.**

Family: Compositae

Botanical description: Small herb with a single peduncle with 4-15(-25) cm; Leaves at the base, with 10-60 x 4-20 mm, oblanceolate to broadly obovate-spathulate, subentire to crenate-serrate, bright green; Flowers grouped in capitula with 15-30 mm in diameter, with marginal white flowers (sometimes slightly purplish) and yellow central flowers. The fruit with 1-1.5 mm.

Habitat/Localization: Pastures, roadsides and others grassy habitats. **PR7 – Riparian zone**

Flowering: January to September

***Calystegia sepium* (L.) R. Br.**

Family: Convolvulaceae

Botanical description: Herbaceous plant; Stems up to 400 x 0.28 cm, climbing, very branched; Leaves with (40)50-130(170) x (20)30-70(90) mm, entire, ovate-lanceolate, more or less sagittate; Flowers in groups of 1(2), white, rarely pink coloured; Fruit with 10-16 x 8-10 mm, spherical or ellipsoidal.

Habitat/Localization: Wetland and riversides, brackish water. **PR1 and PR7 - Riparian zone**

Flowering: April to September (October)

***Crataegus monogyna* Jacq.**

Family: Rosaceae

Botanical description: Shrub or small tree up to (5)10m; Stems with spines up to 2.5 cm; Simple leaves sometimes leathery, deeply lobed with 1-2(3) pairs of lobes; Flowers in groups of 4-11, white; Fruit subspheric to cylindrical in shape, 5.5-10(12.8) x 4.4-9.5(10.8) mm, red.

Habitat/Localization: Woodland edges. **PR1 and PR7 - Riparian zone**

Flowering: February to July (October)

***Cuscuta campestris* Yunck.**

Family: Convolvulaceae

Botanical description: Herbaceous parasite plant; Stems up to 1.2 mm diameter, twining and climbing on the host plant, very branched, orange, hairless; White flowers with 1.5-3 mm, in groups with (3)5-10(12) mm; Fruit (2)2.5-3.5(4) x 2.2-4.2 mm, subspheric, glabrous, with 1-4 seeds.

Habitat/Localization: Soils which have been modify such as margins of paths and crop fields. **PR7- Riparian zone**

Flowering: May to October

***Frangula alnus* Mill.**

Family: Rhamnaceae

Botanical description: Shrub or tree up to 12(15) m; Bark slightly rough, light brown to greyish; Smaller leaves at the base of the sprigs and increasing towards the apex; Leaves (10)20-140 x (5)10-65 mm, lanceolate to obovate with entire or undulate margin; Flowers in groups of (1)4-8(12), each with 2-6 mm, greenish yellow; Fruit distinctly fleshy, with 5-8(10) x 5-7(10) mm, glabrous, red becoming black.

Habitat/Localization: Riparian and oak forest, marshes and moist soils. **PR1** and **PR7 - Riparian zone**

Flowering: March to July (September)

***Galium palustre* L.**

Family: Rubiaceae

Botanical description: Herb; Stems 17-129 cm x 0.4-1.4 mm, erect or ascendant; Leaves 5-38 x (0.9) 1-6.5(8.5) mm, in whorls of 4-6 on the main branches, oblong, elliptical or +/- obovate, obtuse; Flowers are grouped in a more or less pyramidal or obovoid shape with 7-40 cm each with (1.8) 2-4 (4.7) mm in diameter, white. Fruit 2-3 mm, more or less smooth.

Habitat/Localization: Wet meadows, banks of watercourses, pond margins and flooded sites. **PR1** and **PR7 – Riparian zone**

Flowering: May to August (September)

***Lonicera periclymenum* L.**

Family: Caprifoliaceae

Botanical description: Climber shrub with (2)3-5(6) m; Branchy stems, hairless; Leaves opposite, elliptical to oblong-elliptical; Flowers in groups of (14) 17-35(51) in a terminal head, each with (27)36-45(58) mm, rose or white-rose and later yellowish; Fruit is red with (5.5)8-9(11) mm.

Habitat/Localization: Brambles and riparian hedges in more or less dark places. **PR1-Riparian zone**

Flowering: (May) June to July (September)

***Rosa sempervirens* L.**

Family: Rosaceae

Botanical description: Shrub up to 6 m or more; Stems hairless, green or reddish, with sparse and curved prickles; Compound leaves, leaf segments (3)5(2.5)3-8 x 1.5-3.5 cm, leathery, ovate to ovate-lanceolate, hairless, shining; Solitary flowers with 2.5-5 cm in diameter, white; Fruit 0.5-1.6 cm in diameter, spherical when mature, red.

Habitat/Localization: Shrubland hedges of streams and paths**,** preference for moist and fresh soils. **PR1** and **PR7 – Forest and riparian zone**

Flowering: April to August

***Lycopus europaeus* L.**

Family: Labiatae

Botanical description: Herb with 21-92 cm; Erect stems, simple or branched; Leaves with 2.1-11 x 0.8-3.6 cm, lanceolate, elliptical or ovate; Axillary flowers grouped in dense whorls with of 1-1.8 cm in diameter each with 3-3.5 mm, cream coloured with purple spots; Fruit with 1.3-1.5 x 1.1 mm, bright.

Habitat/Localization: Soggy places, margins of rivers and lakes, wetlands on any kind of substrate. **PR7-Riparian zone**

Flowering: (April, June) July to October

***Mentha suaveolens* Ehrh.**

Family: Labiatae

Botanical description: Herb with 38-87 cm; Stems ≤ 4 mm in diameter at the bottom, more or less hairy; Leaves opposite, 18-52 x 9-37 mm, elliptical to ovate or rounded, dentate or serrate, white hairy beneath; Flowers grouped in terminal spike shape with 2.7-10 x 0.6-1.2 cm; Flowers with 3-3.8 mm, usually cream or white and sometimes purple; Fruit with 0.7-0.8 x 0.5-0.6 mm, ellipsoid to ovoid, dark brown.

Habitat/Localization: Humid places on any substrate. **PR1** and **PR7 – Riparian zone**

Flowering: March, May to November

***Myosoton aquaticum* (L.) Moench.**

Family: Caryophyllaceae

Botanical description: Herb; Stems with 15-60(120) cm, hairy on the top; Leaves 2-6(8) cm, opposite, ovate-acuminate to lanceolate-acuminate; Flowers 12-15 mm in diameter, white; Fruit is a capsule.

Habitat/Localization: Riverbanks, moist and fresh places. **PR1- Riparian zone**

Flowering: May to August

***Nymphaea alba* L.**

Family: Nymphaeaceae

Botanical description: Aquatic plant; Leaves 10-30(50) cm, the apical ones floating, heart-shaped to rounded, hairless; Flowers 5-12 cm in diameter, floating, white; Fruit ovoid-subglobose, maturing underwater.

Habitat/Localization: Stagnant or slow stream freshwater. **PR7- Lagoon**

Flowering: March to October

***Oenanthe crocata* L.**

Family: Umbelliferae

Botanical description: Herb; Hollow stems with 150 x 2 cm; Basal leaves with 30 cm, 3(4)-pinnate, ovate to suborbicular; stem leaves 1-2-pinnate; Flowers grouped on the top of (6)12-30(40) rays with (1.5)3-8 cm long, white; Fruit with (3)4-6.3 mm, cylindrical.

Habitat/Localization: Margin of watercourses and moist places in general**. PR7 – Riparian zone**

Flowering: May to June

***Polygonum hydropiper* L.**

Family: Polygonaceae

Botanical description: Herbaceous plant, glabrous; Stems 20-70(90) cm, branched, erect, reddish; Leaves 4-8 x 0.8-2 cm, ovate-lanceolate; Blossoms are grouped into 1-3(4) flowers, spike-shape, whitish or greenish; Fruit with (2.5)3-3.5 mm, more or less trigonous, brown.

Habitat/Distribution: Near watercourses or on moist soils. **PR1 - Riparian zone**

Flowering: (April) July to October

***Pyrus cordata* Desv.**

Family: Rosaceae

Botanical description: Shrub or small tree up to 15m usually with spiny branches; Bark with longitudinal grooves; Leaves ovate to ovate-lanceolate, crenate-dentate or serrulate margin, pubescent when young; Flowers are grouped, white; Fruit globose or obovoid, shiny and red.

Habitat/Localization: Woods and hedges of paths and crop fields. **PR1 - Riparian zone**

Flowering: April to June

***Rorippa nasturtium-aquaticum* (L.) Hayek.**

Family: Cruciferae

Botanical description: Plant with 20-100 cm, rooting at the nodes; Erect or ascendant stems; Stem leaves 2-18 x 1-6(7) cm, with (1)2-6 pairs of segments; Flowers grouped, each with 3.5-4.5 x 1.5-2 mm, white or somewhat violet; Fruit 10-20(24) x (1.5)2-3 mm.

Habitat/Localization: Shallow water, river banks and lagoons. **PR1- Riparian zone**

Flowering: January to November (December)

***Smilax aspera* L.**

Family: Smilacaceae

Botanical description: Plant with woody stems up to 6 (10m) m creeping or climbing, angled, grooved, prickly (spines 1-6.6 mm); Leaves alternate, (15)42-68 x (4.4)24-59 (103) mm, with leather consistency, usually heart-shaped and with spines; Flowers in groups with 11-123 mm long, whitish and in zigzag; Fruit with 4.1-9.6 mm, globose, black when ripe.

Habitat/Localization: Pinewoods, holm and cork oak, and riparian zones. **PR1** and **PR7 - Forest zone**

Flowering: April to December

***Tradescantia fluminensis* Velloso.**

Family: Commelinaceae

Botanical description: Herbaceous plant; Prostrate or ascending stems with (10)20-60 cm and rooting at the basal nodes; Leaves up to 10 cm ovate to elliptical, green; Flowers in groups of 2-12, each flower with 3 white petals; Fruit is a capsule with 2 seeds.

Habitat/Localization: Naturalized (native from SE South America) behaving as a locally invader in areas such as riparian, understory and pathways. **PR1** and **PR7 – Riparian zone**

Flowering: (March) April to May (June)

***Trifolium repens* L.**

Family: Leguminosae

Botanical description: Herb with 1-60 cm, rooting at the nodes; Leaves with 3 segments with 3-47 x 3-36 mm each, segments obovate to rounded; Flowers numerous in a hemispherical group with 10-40 mm, usually white or rarely pink purple; Fruit a legume linear, compressed.

Habitat/Localization: Meadows, riverbanks and water sources. **PR1 and PR7- Riparian zone**

Flowering: (January) March-October(November)

***Zantedeschia aethiopica* (L.) Spreng.**

Family: Araceae

Botanical description: Herbaceous plant; Leaves 15-46.5 x 10-25 cm, lamina more or less triangular; Male and female flowers in a group with 10-25 x 12-14.7 cm, protected by a white spathe; Fruit with 1-1.8 x 0.7-1.3 cm, yellow to orange, in groups with 5-8.4 x 3.4-4.5 cm.

Habitat/Localization: Naturalized nearby gardens, villages and forest on moist and nitrified soils. **PR7- Riparian zone**

Flowering: December to July

Plants with yellow flowers

***Acacia dealbata* Link.**

Family: Leguminosae

Botanical description: Tree with (6)12-15(30) m; Bark brown greyish; Leaves green-greyish, persistent, 2-pinnate with 10-26 pairs of pinnae; Flowers grouped in a globose shape with 25-30 flowers each; Flowers golden yellow; Fruit with 5-8 x 0.8-1.2 cm, compressed, brow or bluish green.

Habitat/Localization: Planted as an ornamental or in dunes, naturalized and invasive, particularly after fires. **PR7** and **PR1 - Riparian zone**

Flowering: January to March

***Limniris pseudacorus* (L.) Fuss.**

Family: Iridaceae

Botanical description: Herbaceous plant; Erect stems with 65-130 x 0.6-13 mm; Leaves deciduous with protruding midrib, basal leaves with 38-100 x 1.8-3.3 cm, stem leaves with 25-40 x 1.2-2.5 mm; Flowers (2-12) grouped ate the apex, yellow flowers usually with orange or brown basal spots, bordered by short brownish lines; Fruit with 35-75 x 12-26 mm, cylindrical with a short beak.

Habitat/Localization: Grasslands, near riverbanks, water courses, swamps, in sandy or loamy soils. **PR1** and **PR7 – Riparian zone**

Flowering: (March) April to July

***Lysimachia vulgaris* L.**

Family: Primulaceae

Botanical description: Herbaceous plant; Stems with 0.4-1.3(1.5) m long, erect, often branched; Leaves (4)6-13.5(15.5) x 2-4(5) cm, entire, opposite or in whorls of 3-4, ovate-lanceolate; Flowers with 5 lobes, 8-10(12) mm in diameter, yellow; Fruit with 4 mm, more or less bright, reddish-brown.

Habitat/Localization: Edges of current and stagnant water, flooded soils in general. **PR7-Riparian zone**

Flowering: June to August(November)

***Narcissus bulbocodium* L.**

Family: Amaryllidaceae

Botanical description: Herbaceous plant 8-35 cm with a bulb; Cylindrical single stem, smooth; Solitary yellow flower with green sidebands and a terminal corona (8.4-23.9 mm long and 13.7-43.4 mm diameter); Leaves 2 or 3(5) from each bulb, with 7-31 x (0.10)0.16-0.23(0.43) cm, with a semicircular cross-section; Fruit is oblong-ovoid, 15.1-19.68 x 5.8-9.4 mm, with black and shiny seeds.

Habitat/Localization: Shrub, rocky ground, grasslands, land temporarily flooded. **PR7 - Riparian zone**

Flowering: February to May (June)

***Parentucellia viscosa* (L.) Caruel.**

Family: Scrophulariaceae

Botanical description: Herb; Stems with 10-35(60) cm, erect, simple or branched at the base, yellowish green, with viscous (glandular) hairs; Leaves (10)17-35(45) x 6-12 mm, ovate-lanceolate with a dentate margin; Flowers (15)18-23mm, yellow or white-yellowish; Fruit with (7)9.5-12 x 3-4 mm, ellipsoidal, with hairs.

Habitat/Localization: Pastures, nitrified and moist soils. **PR1 – Riparian zone**

Flowering: April to June (July)

***Potentilla erecta* (L.) Raeusch.**

Family: Rosaceae

Botanical description: Herb; Fertile stems (2)10-40(75) cm, 0.3-2 mm in diameter at the base, simple or rarely branched; Leaves in rosette, palmatisect with 3(4-5) segments; Solitary flowers 1-75 for stem, with 4 yellow petals with (3)4-6 mm; Fruit with (1.2)1.5-2 mm, glabrous.

Habitat/Localization: Wet pastures, watercourses and wet places. **PR1 – Riparian zone**

Flowering: February to September (December)

Ranunculus bulbosus* L.** subsp. ***bulbosus

Family: Ranunculaceae

Botanical description: Herb with (4)5-50(65) cm, hairy; Thickened stock, double bulb; Basal leaves (8)13-60(75) x (10)20-70(95) mm, ovate, more or less segmented, upper leaves with segments lanceolate or linear; Flowers with 5 petals, (13)15-27(30) mm in diameter, golden yellow; Fruit is a head of achenes (2.5)3-3.7(4.2) mm, dark brown.

Habitat/Localization: Moist and fresh pastures, abandoned crop fields. **PR7 – Riparian zone**

Flowering: April to August (September)

***Ranunculus ficaria* L.**

Family: Ranunculaceae

Botanical description: Herb; Branched stems (3)5-50 cm; Leaves ovate to reniform, cordate, (5)10-60(65) x (8) 15-65(70) mm; Flowers (7)10-40(45) mm in diameter, yellow; Fruit is a head of achenes 2-3.5(4) mm, ovoid.

Habitat/Localization: Moist lands, streams, pastures and any type of substrate. **PR1 – Riparian zone**

Flowering: January to June (October to December)

***Ranunculus repens* L.**

Family: Ranunculaceae

Botanical description: Herb; Stems (10)13-45(60) cm, erect, hairy, rooting at the nodes; Basal leaves 25-85(120) x 32-110(145) mm, with ovate to obovate segments, upper leaves not segmented or with oblong-lanceolate to linear segments; Flowers with 5 petals, (12)15-30 mm in diameter, golden yellow; Fruit is a head of achenes 3-3.5(4) mm, obovoid.

Habitat/Localization: Wetlands, pastures, on any type of substrate. **PR1 – Riparian zone**

Flowering: March to July

***Rorippa amphibia* (L.) Besser.**

Family: Cruciferae

Botanical description: Herb with (40)80-130 cm; Erect stems, rooting at the nodes; Leaves 5-13(17) x 1-3.5(6) cm, elliptical to ovate, entire or more or less segmented; Flowers with 4 petals, 3-4 x 2-2.2 mm, yellow; Fruit 3-5.5(7) x 1-2 mm, ellipsoidal to obovoid.

Habitat/Localization: Rivers banks, in waterlogged soils and shallow waters. **PR1- Riparian zone**

Flowering: April to September

***Thalictrum speciosissimum* L.**

Family: Ranunculaceae

Botanical description: Herbaceous plant; Stems 100-160(180) cm, erect; Basal leaves triangular-ovate and 2-5 ternate, upper leaves with 3 lobes; Flowers densely grouped in a cylindrical shape; Fruit is an ellipsoidal achene.

Habitat/Localization: Reeds and moist streams all the year. **PR1- Riparian zone**

Flowering: (April) May to July (August)

Plants with very small or without evident flowers

***Alnus glutinosa* (L.) Gaertner.**

Family: Betulaceae

Botanical description: Tree up to 25 m; Bark is dark and fissured in adult; Leaves 4-10 (14) cm, nearly rounded usually green on lower surface and with tufts of yellowish hairs in the axils of the veins, bisserate; Male catkins 30-75 x 2-6 mm, deciduous; Fruiting catkins 10-25 mm x 7-12 mm, green when young and dark when mature, in a cluster of 2-5.

Habitat/Localization: Riverbanks, riverine, wetlands and valleys. **PR1 - Riparian zone**

Flowering: January to May

***Atriplex prostrata* Boucher ex DC.**

Family: Chenopodiaceae

Botanical description: Herb up to 120 cm; Stems with green whitish grooves; Leaves 1-8 x 0.7-8 cm, the upper usually ovate-lanceolate, and the basal leaves hastate or triangular; Female flowers and fruits with triangular to triangular-ovate shape.

Habitat/Localization: Land removed, modified and nitrified. **PR1 - Riparian zone**

Flowering: July to September

***Callitriche stagnalis* Scop.**

Family: Callitrichaceae

Botanical description: Aquatic herbaceous plant up to 30 cm with floating rosettes of 6-10 leaves; Stems up to 0.4-1.1 mm in diameter, green or yellowish green; Floating leaves with 3.8-13(19) x 2.8-8 mm, rounded-elliptical, opposite; Flowers solitary. Fruits 1.1-1.8 x 1.2-1.6 mm, obovoid or almost spherical.

Habitat/Localization: Standing, transparent and slightly eutrophic waters, lagoons, also in moist soils on the banks of lakes and rivers. **PR1** and **PR7 - Riparian zone**

Flowering: January to October

***Carex cuprina* (I, Sándor ex Heuff.) Nendtv. ex A. Kern.**

Family: Cyperaceae

Botanical description: Herbaceous plant; Stems with 30-100(120) cm, trigonous in shape; Leaves (2,5)3,5-7(8) mm wide, flat and rough on top, orange when dry, shorter than the stems; Flowers grouped in an oblong or pyramidal shape with 2.5-4.5(5.5) cm long; Fruit with 1.7-2.1 x 1.2-1.6 mm, obovate or elliptical.

Habitat/Localization: Wet meadows, waterlogged land and watercourses. **PR1 – Riparian zone**

Flowering: March to June(July)

***Carex pseudocyperus* L.**

Family: Cyperaceae

Botanical description: Herbaceous plant; Stems with (30)40-80(100) cm, trigonous in shape; Leaves with (5)7-10(11) mm wide, flat and very rough in the edges, longer than the stems; Male flowers grouped in a linear solitary spike with (24)40-60 (80) mm long, female flowers grouped in 3-5 very dense spikes with 20-50 (70) mm; Fruit with 1.4-1.8 x 0.8-1 mm, ovate, light brown.

Habitat/Localization: Margins of ponds and moist soils. **PR7 – Riparian zone**

Flowering: (March) April-July(August)

***Cyperus eragrostis* Lam.**

Family: Cyperaceae

Botanical description: Herbaceous plant with a short and thick rhizome; Usually solitary stems, up to 80 cm and with a trigonal shape; Leaves mainly basal, usually shorter than the stem, with (18)29-44(55) x (0.4)0.5-7.5 (10) cm; Flowers grouped at the apex, somewhat spherical, rays with 0.3-13 cm long; Spikelets compressed, reddish or yellowish with a greenish band in the centre; Fruit with (0.9)1-1.2(1.3) x 0.4-0.6 mm, obovoid, dark grey or dark.

Habitat/Localization: Wetlands, road paths**,** on the side of water courses. **PR1** and **PR7 - Riparian zone**

Flowering: April to October

***Cyperus longus* L.**

Family: Cyperaceae

Botanical description: Herbaceous plant; Stems with (33)37-78(110) cm, solitary, with a trigonal shape in cross section; Leaves (17)21-34(54) x 0.2-0.5 cm, basal, flat; Flowers grouped at the apex, in 6-10 trigonal rays up to 12(30) cm long; Spikelets reddish-brown with a greenish band in the centre; Fruit with 1-1.5 x 0.4-0.5 mm, obovoid, dark brown or dark when mature.

Habitat/Localization: Lagoons banks and paths and also in crop lands. **PR1** and **PR7 – Riparian zone**

Flowering: May to November

***Fraxinus angustifolia* Vahl.**

Family: Oleaceae

Botanical description: Tree up to 15(25) m, bark deeply fissured and greyish; Stems yellow or grey-brown; Leaves with 9.2-28 cm long, composed by (5)7-13(15) leaflets with a lanceolate, oblong-lanceolate, ovate-lanceolate or elliptic shape and a serrate margin; Flowers grouped, appearing before the leaves; Fruit with 22.8-47.8(55) x 4.2-10.6 mm, lanceolate to oblong-lanceolate, yellowish-brown when mature, with one seed.

Habitat/Localization: On the banks of watercourses, dark woods, fresh and deep substrate. **PR1** and **PR7 – Riparian zone**

Flowering: December to April (May)

***Hydrocotyle vulgaris* L.**

Family: Umbelliferae

Botanical description: Hairless herb; Stems with internodes of 0.2-9 cm; Leaves 0.6-4(4.6) x 0.6-4(4.6) cm, rounded to subrounded, with (7)8-9 main nerves; Flowers in groups of 2-6(8) each with 0.5-12 cm, whitish to greenish-yellow; Fruit 1.4-2 x 1.4-2.8 mm, yellow, reddish brown dotted.

Habitat/Localization: Riverbanks, streams and wetlands. **PR1 – Riparian zone**

Flowering: May to October

***Juncus effusus* L.**

Family: Juncaceae

Botanical description: Herbaceous multicaulis green plant with 25 – 128 cm; Stems with 200-1030 x 1-5 mm, with a cylindrical shape; Leaves all basal, 4-5 in each sprout; Flowers group with 8-10 cm and pseudolateral position, flowers usually pale brown and a somewhat stinging bract which seems an extension of the stem; Fruit with 1.5-2.3 mm, obovoid or ellipsoidal, yellow or brownish, bright.

Habitat/Localization: Wet areas, stream, deep and wet soils. **PR1** and **PR7 – Riparian zone**

Flowering: June to September

***Laurus nobilis* L.**

Family: Lauraceae

Botanical description: Shrub or small tree with 5-10 m with smooth bark; Erect twigs and the youngers are glabrous and glossy; Leaves with 6-15 x 2-5 cm, oblong-lanceolate with undulate margin, hairless, green above and pale beneath; Flowers in groups of 4-6, yellowish green or whitish; Fruit with 10-15 mm in diameter, black.

Habitat/Localization: Wet and gloomy ravines of coastal regions of Mediterranean and Atlantic. **PR1** and **PR7 – Riparian zone**

Flowering: February to April

***Molinia caerulea* (L.) Moench.**

Family: Gramineae

Botanical description: Herbaceous plant; Stems with cylindrical shape, 15-150(250) cm, erect and rigid; Leaves 10-50 cm x 1-12 mm, deciduous, scabrid on the margins; Flowers grouped in spikelets with 4-9 mm each, purple, brownish, yellowish or green forming a spike-like structure compacted with 5-40(70) cm.

Habitat/Localization: Wet or waterlogged sites such as meadows, banks of watercourses. **PR7 – Riparian zone**

Flowering: June to October

***Myriophyllum aquaticum* (Velloso) Verdc.**

Family: Haloragaceae

Botanical description: Aquatic herb; Stems up to 2 m, simple and branched, erect-ascending, green or brown; Verticillate leaves 15-40 mm, 4-6 per node, with 8-30 segments 3-6 mm each; Petals with (4)5xc. 0.8 mm (null in female flowers); Fruit 1.5-2 x c. 1.2 mm, ovoid, papillose.

Habitat/Localization: Watercourses, rivers and waterlogged soils. **PR7-Lagoon**

Flowering: May to October

***Phragmites australis* (Cav.) Steudel.**

Family: Gramineae

Botanical description: Plant with 0.8-4 m and a long, woody subterranean portion (rhizome); Stems erect, cylindrical, usually simple, with internodes; Leaves linear, flat, up to 50 x 5 cm, greyish-green, gradually tapering to a long, slender apex; Flowers grouped in spikelets forming a plume shape with 15-40(50) cm, often brown to purplish.

Habitat/Localization: Wet lands, margins of rivers, lagoons and ditches. **PR1** and **PR7 - Riparian zone**

Flowering: July to September

***Populus alba* L.**

Family: Salicaceae

Botanical description: Tree up to 25 m; Bark white-greyish, smooth in young trees and longitudinally fissured in aged trees; Leaves with lamina (1.5)4-9 x (11)3-7 cm, dark green above and white or greyish green beneath, subrounded, subelliptical or subpentagonal, entire to sinuate-dentate margin; Male and female flowers produced in distinct trees, flowers grouped in catkins that appearing before the leaves; Fruit with c. 4 mm, oblong-conical.

Habitat/Localization: Riverbanks, planted as ornamental tree. **PR1 – Riparian zone**

Flowering: (January) February-April

Populus nigra L.

Family: Salicaceae

Botanical description: Tree up to 30 m; Bark grey and smooth in young trees and with longitudinal fissures in aged trees; Simple leaves 5-10 x 4-8 cm, rhomboidal to triangular-ovate, with crenate-serrate margin; Male and female flowers produced in distinct trees, flowers grouped in catkins that appearing before the leaves; Fruit with 7-9 cm, ellipsoidal.

Habitat/Localization: River streams communities, planted as ornamental. **PR1** and **PR7 – Riparian zone**

Flowering: February to March

***Quercus robur* L.**

Family: Fagaceae

Botanical description: Deciduous tree up to 30(40) m; Bark grey-brown that darken with the age; Leaves 5-18 x 2.2-10 cm, obovate or oblong-obovate, pinnatilobate to pinnatifid, dark green above and light green beneath, glabrous; Male catkins with 5-13 cm, spike shaped, pendent, with numerous flowers; Fruit an oblong nut (20-40 x 8-18 mm), the base enclosed by the enlarged cupule (8-15 x 15-20 mm)

Habitat/Distribution: Deep and fresh soils, in temperate climates without or with short dry periods. **PR1 and PR7 - Riparian zone**

Flowering: April- June

***Rumex conglomeratus* Murray.**

Family: Polygonaceae

Botanical description: Herbaceous plant up to 1.3(1.6) m; Stems one or various per plant, erect and striated; Basal leaves with (20)30-160(210) x (7)13-50(70) mm, ovate-lanceolate; Flowers grouped; Valves with (2)2.5-3(3.2) x 1-1.7 mm, entire, ovate-oblong or tongue-shaped, developing tubercles with 1-1.5-2 mm; Fruit with 1.6-1.9 mm, reddish-brown.

Habitat/Localization: Margins of water courses, pastures and moist and changed lands. **PR1** and **PR7-Riparian zone**

Flowering: May to August

***Rumex crispus* L.**

Family: Polygonaceae

Botanical description: Herbaceous plant up to 1.3(2.5) m; Stems one or various per plant, erect and striated; Basal leaves (35)60-260(500) x (7)10-70(140) mm, oblong-lanceolate with an undulate margin; Flowers grouped; Valves (3)3.5-5(6) x 3-5(6) mm, entire or denticulate, ovate-triangulate, developing tubercles with (1.2)1.5-2(2.5) mm; Fruit with 1.7-3(3.5) mm, dark reddish-brown.

Habitat/Localization: Moist and nitrified pastures, margins of water courses. **PR1 and PR7 – Riparian zone**

Flowering: April – June (September)

***Rumex obtusifolius* L.**

Family: Polygonaceae

Botanical description: Herbaceous plant up to 1.5 m; Stems erect and striated; Basal leaves with (70)90-270(300) x (55)60-140(160) mm, ovate-oblong; Flowers grouped; Valves with (3.5)4-5.5 x 2-3.5 mm, ovate-triangulate with 1-2 teethes on each side, developing tubercles with 1.5-2.5 mm; Fruit with 2.5-3 mm, dark reddish-brown.

Habitat/Localization: Moist pastures, margins of water courses. **PR7 – Riparian zone**

Flowering: May – September(November)

***Salix alba* L.**

Family: Salicaceae

Botanical description: Tree up 25m; Bark grey with deep longitudinal fissures; Branches ascending, long, flexible with bark smooth and brown; Leaves 10 x 1-2.5 cm, lanceolate, finely serrate, covered with whitish silky hairs on both surfaces; Male and female flowers produced in distinct trees, appearing with de leaves, flowers grouped in catkins.

Habitat/Localization: Riverine and wetland areas like riverside and streams, sandy and clayey soils. **PR7 - Riparian zone**

Flowering: March to May

***Salix atrocinerea* Brot.**

Family: Salicaceae

Botanical description: Tall shrub or small tree up to 12m; Bark with longitudinal groves; Leaves 2-10 x 1-2 cm, lanceolate or oblong-lanceolate, slightly denticulate, with ferruginous hairs beneath; Male and female flowers produced in distinct trees, appearing before the leaves, flowers grouped in catkins with 7 x 1-2 cm.

Habitat/Localization: Moist soils, rich in nitrogen or not, like riverbanks and lagoons. **PR1** and **PR7 – Riparian zone**

Flowering: January to March (April)

***Salix babylonica* L.**

Family: Salicaceae

Botanical description: Tree up to 15m; Bark thick with irregular longitudinal grooves; Branches long, pendent, drooping almost to the ground; Leaves nearly lanceolate or linear-lanceolate, serrate margin, hairless at maturity; Male and female flowers produced in distinct trees, flowers grouped in catkins up to 2 x 0.3- 0.4 cm.

Habitat/Localization: Located preferably at watercourse margins, widely planted and sometimes more or less naturalized. **PR7 - Riparian zone**

Flowering: March to June

***Salix viminalis* L.**

Family: Salicaceae

Botanical description: Tall shrub or small tree up to 10 m; Twigs when young are long and flexible, green, greyish, yellowish or brown when mature; Leaves 10 x 1cm, linear or linear-lanceolate, entire or dentate margin, green above, silky beneath; Male and female flowers produced in distinct trees, appearing before the leaves and grouped in catkins.

Habitat/Localization: Wet lands and land fields that are influence by man. **PR1** and **PR7 - Riparian zone**

Flowering: March to April

***Schoenoplectus lacustris* (L.) Palla.**

Family: Cyperaceae

Botanical description: Herbaceous plant; Solitary stems with (30)50-200(300) cm x (1)3-12(15) mm with cylindrical shape, green; Leaves are reducing to the base of the stems; Flowers grouped in ovoid to ovoid-lanceolate spikelets with (1.5)2-8.5(15) cm, arranged in a head with unequal rays; Fruit with (1.7)1.8-2.8(3) x (1.3)1.5-2.2 mm, yellow when young and grey to dark when mature.

Habitat/Localization: Margins of lagoons and watercourses. **PR1 and PR7 – Riparian zone**

Flowering: April – October (November)

***Tamus communis* L.**

Family: Dioscoreaceae

Botanical description: Climbing hairless plant; Stem up to 4 m or more, with cylindrical shape, longitudinally striate, branched; Leaves (2)5.7-9.2(23) x (0.9)3.7-6.6(20) cm with 3-9 main veins; Male plant with flowers greenish-yellow; Female plant with greenish flowers; Fruit with (0.6)0.85-1.10(1.5) mm in diameter, somewhat globose and red when ripe.

Habitat/ Localization: Woods, shrubs and hedges. **PR1 - Forest zone**

Flowering: (February) March to June (July)

***Typha latifolia* L.**

Family: Typhaceae

Botanical description: Aquatic or semi-terrestrial herbaceous plant up to 3 m with subaquatic portion (rhizome); Stems erect with cylindrical shape, simple; Leaves mostly basal with 45-120 x 0.8-2.5 cm, linear and elongate, with variable length, fleshy; Flowers grouped in a spike shape, the lower portion with 12-35 x 1.5-3 cm and dark brown coloured; Fruit with a fusiform shape with 1-1.5 mm.

Habitat/Localization: Moist soils, flooded or waterlogged for most of the year in fresh or slightly mineralized water. **PR1** and **PR7 - Riparian zone**

Flowering: April to November

5.6.2.1. Illustrated descriptive species

As an example, it was elaborated six proposals for the illustrated descriptive species sheets shown as follow:

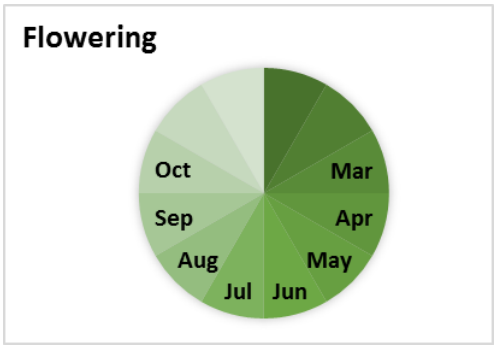
Osmunda regalis L.

Family: Osmundaceae

Botanical description: Fern with a short and stout rhizome, covered by persistent leaf-bases; Leaves with 30-150 cm in a dense crown (only the inner is fertile), not persistent, bi-pinnate (B); Fertile portion (sori with spores) only in the apex of leaves (C), replacing the green tissue, not occupying more than ¼ of the leaf; fertile pinnae pale green, quickly turning brown (A).

Habitat: Most common in wetlands, preferably acidic, like as riverbanks, small rivers, and woodlands.

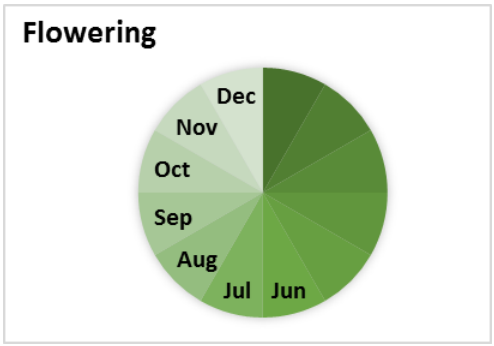
Localization: PR1– Riparian zone



Eichhornia crassipes (Mart.) Solms

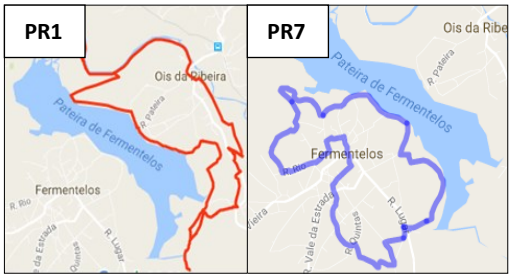
Family: Pontederiaceae

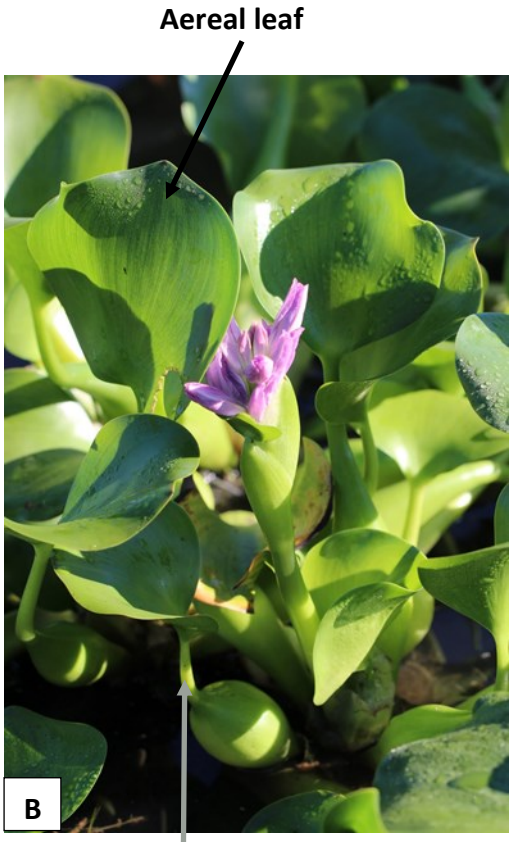
Botanical description: Floating aquatic plant with a short and floating rhizome (A); Aerial leaves arising in tufts, lamina 2.5-14 x 3.5-9.5 (13) cm, somewhat rounded, petiole with 3.5-50 x 1.5-3 cm and inflated in the lower half (B); Flowers (4-8) grouped, violet-blue flowers, lobule 1.6-3.7 cm (C); Fruit is a capsule 10-15 x 5-6 mm.

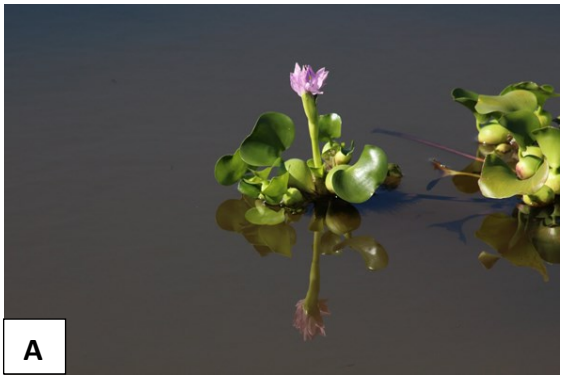


Habitat: Silts, sands or stagnant waters rich in nutrients (eutrophic).

Localization: PR1 and PR7 – Lagoon







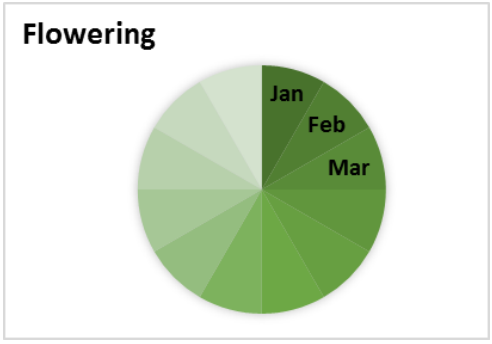
Nymphaea alba L.

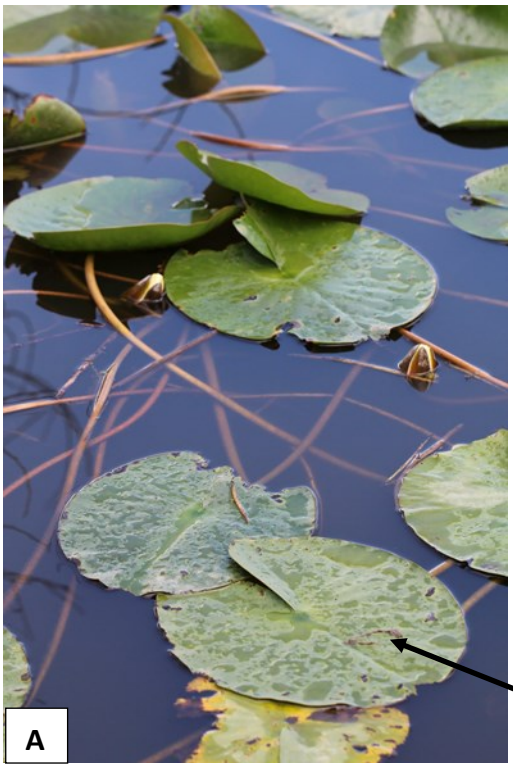
Family: Nymphaeaceae

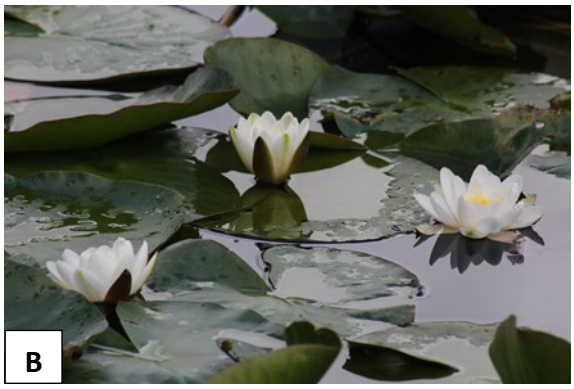
Botanical description: Aquatic plant; Leaves 10-30(50) cm, the apical ones floating, heart-shaped to rounded, hairless (A); Flowers 5-12 cm in diameter, floating, white (B); Fruit ovoid-subglobose, maturing underwater.

Habitat: Stagnant or slow stream freshwater.

Localization: PR7- Lagoon



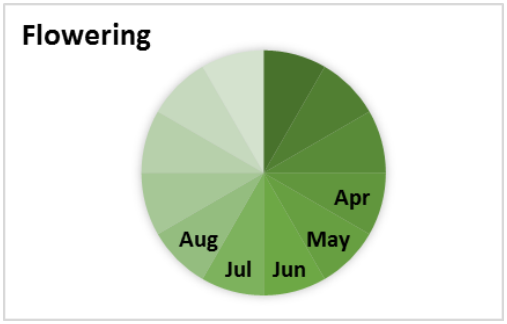




Rosa sempervirens L.

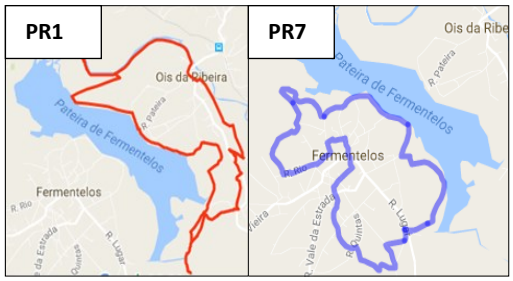
Family: Rosaceae

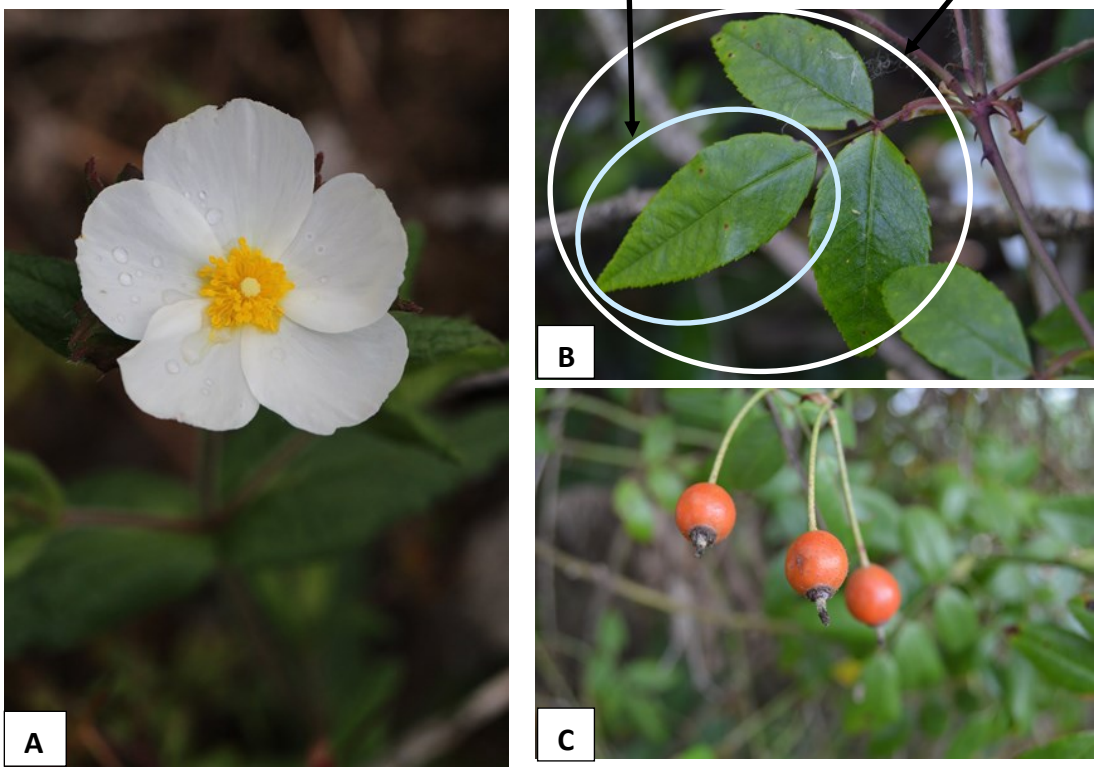
Botanical description: Shrub up to 6 m or more; Stems hairless, green or reddish, with sparse and curved prickles; Compound leaves (B), leaf segments (3)5(2.5)3-8 x 1.5-3.5 cm, leathery, ovate to ovate-lanceolate, hairless, shining; Solitary flowers with 2.5-5 cm in diameter, white (A); Fruit 0.5-1.6 cm in diameter, spherical when mature, red (C).



Habitat: Shrublands hedges of streams and paths**,** preference for moist and fresh soils.

Localization: PR1 and PR7 – Forest and riparian zone

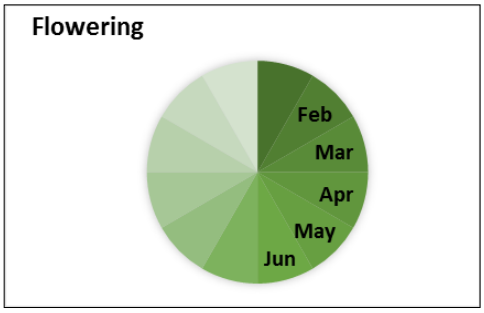




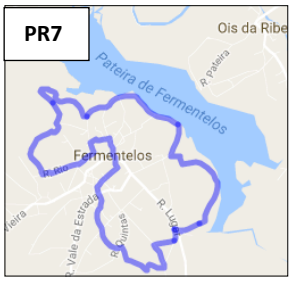
Narcissus bulbocodium L.

Family: Amaryllidaceae

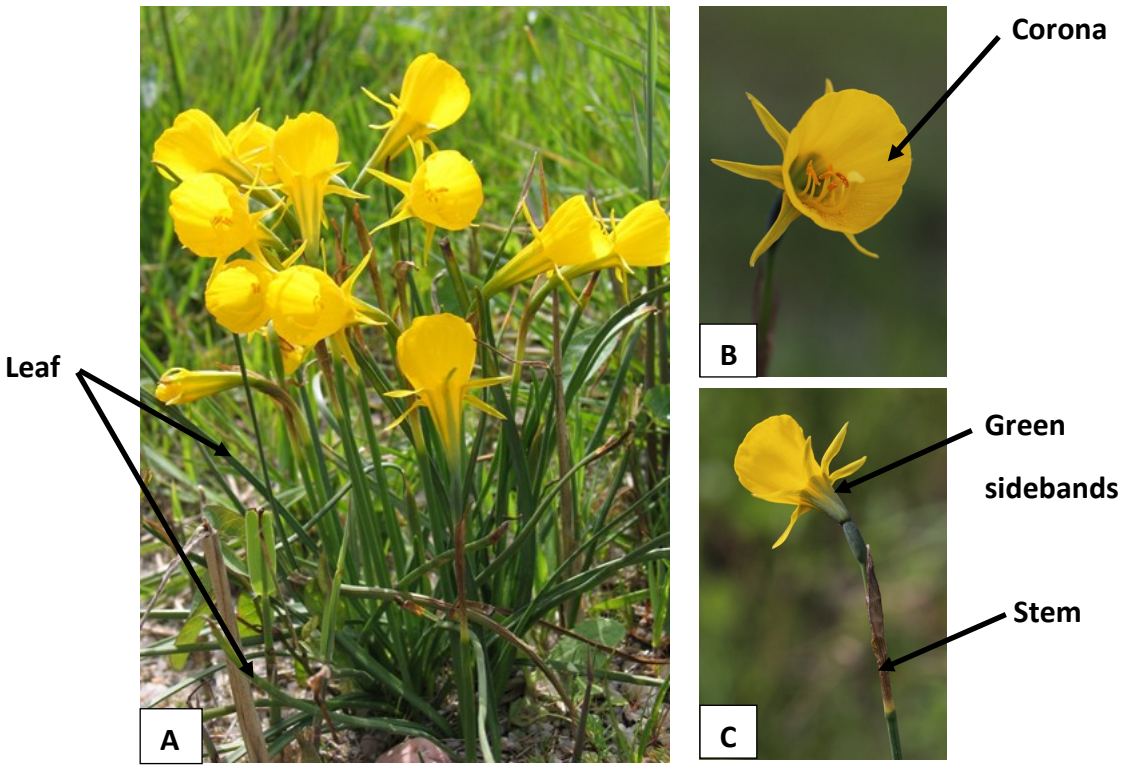
Botanical description: Herbaceous plant 8-35 cm with a bulb; Cylindrical single stem, smooth (C); Solitary yellow flower with green sidebands and a terminal corona (B) (8.4-23.9 mm long and 13.7-43.4 mm diameter); Leaves 2 or 3(5) from each bulb, with 7-31 x (0.10)0.16-0.23 (0.43) cm, with a semicircular cross-section (A); Fruit is a capsule oblong-ovoid, 15.1-19.68 x 5.8-9.4 mm, with black and shiny seeds.



Habitat: Shrub, rocky ground, grasslands, land temporarily flooded.



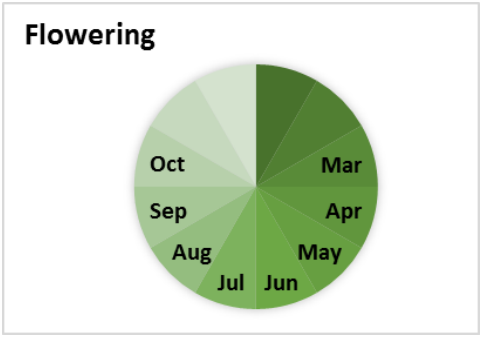
Localization: PR7 - Riparian zone.



Salix atrocinerea Brot.

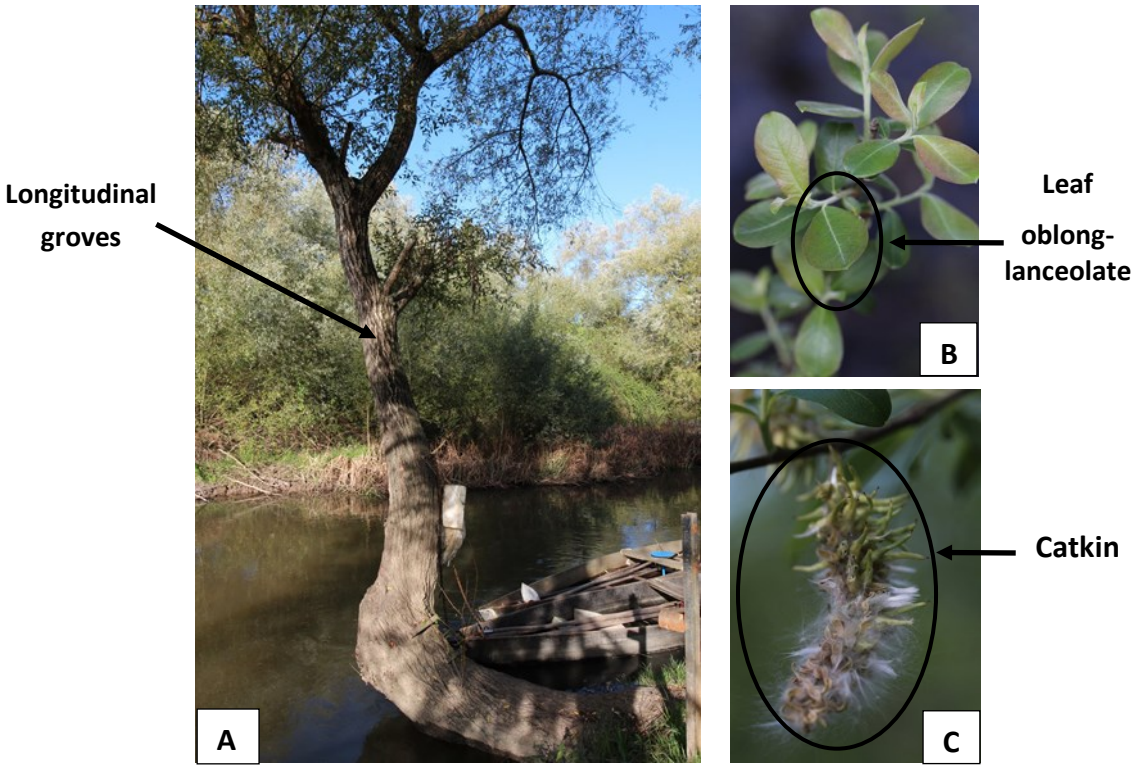
Family: Salicaceae

Botanical description: Tall shrub or small tree up to 12m; Bark with longitudinal groves; Leaves 2-10 x 1-2 cm, lanceolate or oblong-lanceolate (B), slightly denticulate, with ferruginous hairs beneath; Male and female flowers produced in distinct trees, appearing before the leaves, flowers grouped in catkins with 7 x 1-2 cm (C).



Habitat: Moist soils, rich in nitrogen or not, like riverbanks and lagoons.

Localization: PR1 and PR7 - Riparian zone



6. Conclusions and future perspectives

Although Pateira de Fermentelos was the object of various studies related to water quality, trophic state, interactions of groundwater, genotoxic responses on *Anguilla Anguilla* (Almeida 2006; Maria et al. 2006; Bola et al. 2009), control of *Eicchornia crassipes* (Laranjeira & Nadais 2008), and some botanic explorations (Pinho et al. 1988; Borrego et al 1994), there was still no study with the objectives proposed in this MSc thesis.

In fact, with this work it was possible to update the floristic checklist of Pateira de Fermentelos, taking into account that the last inventory was over ten years old. 170 taxa were identified, corresponding to 133 genera, for a total of 64 families. The analysis of **BRAHMS** data provided an increase of 57% in the number of families, 66% in genera and 68% in species/subspecies for the Pateira de Fermentelos AVE collection. The importance of the study area in terms of floristic richness is supported by the location of Pateira de Fermentelos, between the Eurosiberian and Mediterranean region, occurring at overlap of characteristic species of both regions, such as the Atlantic species *Pyrus cordata*, *Quercus robur, Ulex europaeus* and *Ulex minor*, and the Mediterranean species *Daphne gnidium*, *Laurus nobilis*, *Ruscus aculeatus* and *Smilax aspera* (Costa et al. 1998).

In addition, to those species, it was also possible to associate the occurrence of others such as *Typha latifolia, Phragmites australis, Nymphaea alba, Callitriche stagnalis, Myriophyllum aquaticum, Salix alba, Salix atrocinerea, Salix babylonica, Salix viminalis, Alnus glutinosa, Populus alba, Populus nigra, Fraxinus angustifolia, Ulmus minor, Frangula alnus, Lonicera periclymenum,* and *Schoenoplectus lacustris* to this **freshwater habitat**. It is characterized by three distinct types of plant communities, (1) edge communities, (2) floating or submerged communities, rooted in the bottom, and (3) floating communities not rooted in the bottom. Species such as *Quercus faginea, Quercus robur, Crataegus monogyna* and *Ruscus aculeatus* were also found, which are related to the **Forest** habitat that is characterized by several species of the arboreal stratum and for having a complex structure of several herbaceous and shrub species. Beyond those mentioned, species such as *Lavatera cretica*, *Dittrichia viscosa, Lolium multiflorum, Holcus lanatus, Galactites tomentosus, Sonchus oleraceus,* and *Reseda media,* were observed, belonging to the **Seminatural** (**Ruderal)** habitat that are associated to forest, silviculture and agriculture

habitats with human origin or by a natural situation such as progressive abandonment (Alves et al. 2009; Biorede 2016).

Although it was conceivable to make this association, it wasn't possible to describe a natural habitat to Pateira de Fermentelos. Normally, these type of natural habitats have a set of intrinsic properties that are important to keep because allows the preservation of biodiversity, both in the conservation of species as well as in the preservation of the variability within species, and it is fundamental to the maintenance of adequate living conditions for the human species itself. However, they are subject to direct and indirect threats caused by man, such as the destruction or modification of habitats, the introduction of plants and animals from others locations, and threats related to water or air pollution, acid rain and climate changes (Alves et al. 2009). These types of threats in agricultural activities and the planting of eucalyptus and pine trees, which promote the habitat fragmentation, are flagrant in Pateira de Fermentelos, resulting in the inability to identify natural habitats.

The relevance of the study area in terms of flora and vegetation can be also highlighted by the presence of at least five taxa with conservation status: *Narcissus bulbocodium, Ruscus aculeatus, Marsilea quadrifolia, Lycnhis flos-cuculi* and M*yosoton aquaticum*. Otherwise, the problem with invasive species should be a matter of concern because, besides the most aggressive invasive species such as *Eichhornia crassipes* and *Acacia dealbata*, species such as *Tradescantia fluminensis*, *Robinia pseudoacacia, Hakea sericea and Datura stramonium* should be taken into account as the control measures for invaders. Further research should be made on biological control methods of invasive species, including also the species with smaller ranges as a preventive measure to fast propagation.

Unfortunately, the classification a RAMSAR site, has not been given much importance to the preservation of flora and vegetation from Pateira de Fermentelos. The elaboration of a Field Guide, that can be utilized by local people and tourists that use the walking routes, or in environmental educational events, may be a powerful tool in the divulgation and preservation of flora and vegetation of one of the largest freshwater lagoon of the Iberian Peninsula

That is why that the elaboration of tools for divulgation and preservation of biodiversity is so important. The elaboration of identification keys and descriptive sheets quite illustrated, also using a simplified botanical language, will allow to integrate a wider public toward the preservation of the riparian flora and vegetation of Pateira de Fermentelos. In the near future, and using the information collected during the preparation of this thesis, it will be possible to complement the Field Guide with identification keys and descriptive sheets for the forest and ruderal habitats observed in the studied area.

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Annex

Annex I. Floristic checklist of Pateira de Fermentelos.

Family	Species	Phonetics	Lifeform	Common Portuguese name	Habitat
Aceraceae	*Acer negundo* L.	Ácer negúndo	Phanerophytes	Bordo-negundo	Ripirian
Alismataceae	*Alisma plantago-aquatica* L.	Alísma plantágo-aquática	Hydrophytes/ Helophytes	Alface-dos-arrozais	Riparian
Amaryllidaceae	*Narcissus bulbocodium* L.[2]	Narcíssus bulbocódium	Geophytes	Campainhas-do-monte	Riparian
Araceae	*Zantedeschia aethiopica* (L.) Sprengel.	Zantedéschia	Geophytes	Jarro	Riparian
Araliaceae	*Hedera helix* L.	Hédera hélix	Phanerophytes	Hera	Forest
Aspleniaceae	*Asplenium onopteris* L.	Asplénium onópteris	Hemicryptophytes	Avenca-negra	Riparian
	Asplenium trichomanes L.	Asplénium trichómanes	Hemicryptophytes	Avencão	Riparian
Betulaceae	*Alnus glutinosa* (L.) Gaertner.	Álnus glutinósa	Phanerophytes	Amieiro	Riparian
	Betula alba L.	Bétula álba	Phanerophytes	Bidoeiro	Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Boraginaceae	*Echium plantagineum* L.	Échium plantagíneum	Therophytes/ Hemicryptophytes	Lingua-de-vaca	Ruderal
	Glandora prostrata (Loisel.) D.C. Thomas.	Glándora prostráta	Chamaephytes	Erva-das-sete-sangrias	Forest
Callitrichaceae	*Callitriche stagnalis* Scop.	Callítriche stagnális	Hydrophytes/ Helophytes/ Therophytes	Lentilhas-de-água	Aquatic
Caryophyllaceae	*Lychnis flos-cuculi* L. subsp. *flos-cuculi*	Lýchnis flós-Cucúli	Hemicryptophytes	Flor-de-cuco	Riparian
	Myosoton aquaticum (L.) Moench.	Myosóton aquáticum	Chamaephytes	---------	Riparian
	Silene gallica L.	Siléne gállica	Therophytes	Cabacinha	Ruderal
	Silene latifolia Poir.	Siléne latifólia	Hemicryptophytes	Assobios	Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Caprifoliaceae	*Lonicera periclymenum* L.	Lonícera periclýmenum	Phanerophytes	Madressilva	Riparian
	Sambucus nigra L. subsp. *nigra*	Sambúcus nígra	Phanerophytes	Sabugueiro	Riparian
Chenopodiaceae	*Atriplex prostrata* Boucher ex DC.	Átriplex prostráta	Therophytes	Armoles-silvestres	Riparian
Cistaceae	*Cistus psilosepalus* Sweet.	Cístus psilosépalus	Phanerophytes	Saganho	Forest
	Cistus salviifolius L.	Cístus salviifólius	Phanerophytes	Estevinha	Forest
	Xolantha tuberaria (L.) Gallego.	Xolántha tuberária	Hemicryptophytes	Alcar	Forest
Commelinaceae	*Tradescantia fluminensis* Velloso.[1]	Tradescántia fluminénsis	Chamaephytes	Erva-da-Fortuna	Riparian
Compositae	*Andryala integrifolia* L.	---------	Hemicryptophytes	Alface-do-monte	Ruderal
	Aster squamatus (Sprengel) Hieron.	---------	Therophytes/ Hemicryptophytes	Mata-jornaleiros	Riparian
	Bellis perennis L.	---------	Hemicryptophytes	Bonina Margarida	Riparian
	Bidens frondosa L.	---------	Therophytes	Erva-rapa	Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Compositae	*Chamaemelum mixtum* (L.) All.	---------	Therophytes	Margaça	Ruderal
	Coleostephus myconis (L.) Reichenb.	---------	Therophytes	Olho-de-boi	Ruderal
	Conyza bonariensis (L.) Cronq.[1]	---------	Therophytes	Avoadinha-peluda	Riparian
	Dittrichia viscosa (L.) W. Greuter.	---------	Chamaephytes	Tágueda	Ruderal
	Galactites tomentosus Moench.	Galactítes tomentósus	Therophytes	Cardo	Ruderal
	Sonchus asper (L.) Hill.	---------	Therophytes	Sarralha	Ruderal
	Sonchus oleraceus L.	---------	Therophytes/ Hemicryptophytes	Leitaruga	Ruderal
	Tolpis barbata (L.) Gaertner.	---------	Therophytes	Leituga	Ruderal

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Convolvulaceae	*Calystegia sepium* (L.) R. Br.	Calistégia sépium	Hemicryptophytes	Bons-dias	Riparian
	Convolvulus arvensis L.	Convólvulus arvénsis	Hemicryptophytes	Corriola	Ruderal
	Cuscuta campestris Yunck.	Cuscúta campéstris	Therophytes	---------	Riparian
Cruciferae	*Cardamine pratensis* L.	Cardamine praténsis	Hemicryptophytes	Agrião-dos-prados	Riparian
	Raphanus raphanistrum L.	Ráphanus raphanístrum	Therophytes	Saramago	Ruderal
	Rorippa amphibia (L.) Besser.	Roríppa amphíbica	Hemicryptophytes	---------	Riparian
	Rorippa nasturtium-aquaticum (L.) Hayek.	Roríppa nastúrtium-aquáticum	Helophytes	Agrião	Riparian
Cyperaceae	*Carex cuprina* (I. Sándor ex Heuff.) Nendtv. ex A. Kern.	Cárex cuprina	Hemicryptophytes	---------	Riparian
	Carex pseudocyperus L.	Cárex pseudocýperus	Helophytes	---------	Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Cyperaceae	*Cyperus eragrostis* Lam.	Cypérus eragróstis	Geophytes	Junção	Riparian
	Cyperus longus L.	Cypérus lóngus	Helophytes/ Geophytes	Albafor/ Junça	Riparian
	Schoenoplectus lacustris (L.) Palla.	Schoenopléctus lacústris	Geophytes	Bunho	Riparian
Dioscoreaceae	*Tamus communis* L.	Támus commúnis	Geophytes	Arrebenta-boi	Forest
Ericaceae	*Calluna vulgaris* (L.) Hull.	Callúna vulgáris	Phanerophytes	Torga	Forest
	Erica arborea L.	Eríca arbórea	Phanerophytes	Urze-branca	Forest
	Erica australis L.	Eríca austrális	Phanerophytes	Urze-vermelha	Forest
	Erica ciliaris Loefl. ex L.	Eríca ciliáris	Phanerophytes	Cordões-de-freira Urze-carapaça	Forest
	Erica cinerea L.	Eríca cinérea	Chamaephytes/ Phanerophytes	Queiró Urze-Roxa	Forest
	Erica scoparia L. subsp. *scoparia*	Eríca scopária	Phanerophytes	Urze-das-vassouras	Forest
	Erica umbellata Loefl. ex L.	Eríca umbelláta	Phanerophytes	Queiró	Forest

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Fagaceae	*Quercus lusitanica* Lam.	Quércus lusitánica	Phanerophytes	Carvalho-anão	Forest
	Quercus robur L.	Quércus róbur	Phanerophytes	Carvalho-alvarinho	Forest
	Quercus suber L.	Quércus súber	Phanerophytes	Sobreiro	Forest
Geraniaceae	*Geranium dissectum* L.	Geránium disséctum	Therophytes	Coentrinho	Ruderal
	Geranium purpureum Vill.	Geránium purpúreum	Therophytes	Erva-de-são-roberto	Ruderal
Gramineae	*Avena sp.*	---------	Therophytes	Balancos	Ruderal
	Briza maxima L.	---------	Therophytes	Abelhinha	Ruderal
	Briza minor L.	---------	Therophytes	Chocalheirinha	Ruderal
	Cynodon dactylon (L.) Pers.	---------	Hemicryptophytes	Grama	Ruderal
	Cynosurus echinatus L.	---------	Therophytes	Rabo-de-cão	Ruderal
	Dactylis glomerata L.	---------	Hemicryptophytes	Panasco	Ruderal
	Holcus lanatus L.	---------	Hemicryptophytes	Erva-lanar	Ruderal
	Lolium multiflorum Lam.	---------	Therophytes	Azevém	Ruderal
	Molinia caerulea (L.) Moench.	---------	Hemicryptophytes		Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Gramineae	*Phragmites australis* (Cav.) Trin ex. Steudel.	---------	Helophytes/ Hydrophytes	Caniço	Riparian
	Poa annua L.	---------	Therophytes	Cabelo-de-cão	Ruderal
Haloragaceae	*Myriophyllum aquaticum* (Velloso) Verdc. [1]	Myriophýllum aquáticum	Hydrophytes	Pinheirinha-de-água	Aquatic
Hemionitidaceae	*Anogramma leptophylla* (L.) Link.	Anográmma leptophýlla	Geophytes	---------	Forest
Hypolepidaceae	*Pteridium aquilinum* (L.) Kuhn. subsp. *aquilinum*	Pterídium aquilinum	Geophytes	Feto-ordinário	Forest
Iridaceae	*Limniris pseudacorus* (L.) Fuss.	Limníris pseudácorus	Helophytes	Lírio-amarelo-dos-pântanos	Riparian
Juncaceae	*Juncus effusus* L.	Júncus éffusus	Hemicryptophytes	Junco	Riparian
Labiatae	*Ajuga reptans* L.	Ájuga réptans	Hemicryptophytes	Lingua-de-boi	Forest
	Clinopodium vulgare L.	Clinopódium vulgáre	Hemicryptophytes	Clinopódio	Forest
	Lamium maculatum L.	Lámium maculátum	Hemicryptophytes	Chuchas	Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Labiatae	*Lamium purpureum* L.	Lámium purpúreum	Therophytes	Lâmio-roxo	Ruderal
	Lycopus europaeus L.	Lýcopus europáeus	Hemicryptophytes or Helophytes	Marroio-d'água	Riparian
	Mentha aquatica L.	Méntha aquática	Hemicryptophytes/ Helophytes	Hortelã-de-água	Riparian
	Mentha suaveolens Ehrh.	Méntha suavéolens	Hemicryptophytes	Mentastro	Riparian
	Prunella vulgaris L.	Prunélla vulgáris	Hemicryptophytes	Erva-férrea	Riparian
Lauraceae	*Laurus nobilis* L.	Láurus nóbilis	Phanerophytes	Loureiro	Riparian
Leguminosae	*Acacia dealbata* Link.[1]	Acácia dealbáta	Phanerophytes	Acácia-mimosa	Riparian
	Acacia longifolia (Andrews) Willd. [1]	Acácia longifólia	Phanerophytes	Acácia-de-espigas	Forest
	Genista triacanthos Brot.	Genísta triacánthos	Phanerophytes	Ranha-lobo	Forest
	Robinia pseudoacacia L.[1]	Robínia pseudoacácia	Phanerophytes	Falsa-acácia	Riparian
	Trifolium angustifolium L.	Trifólium angustifólium	Therophytes	Trevo-de-folhas-estreitas	Ruderal

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Leguminosae	*Trifolium arvense* L.	Trifólium arvénse	Therophytes	Trevo-branco	Ruderal
	Trifolium campestre Schreb.	Trifólium campéstre	Therophytes	Trevão	Ruderal
	Trifolium pratense L. subsp. *pratense*	Trifólium praténse	Hemicryptophytes	Trevo-dos-prados	Riparian
	Trifolium repens L.	Trifólium répens	Hemicryptophytes/ Chamaephytes	Trevo-rasteiro	Riparian
	Ulex europaeus L.	Úlex europáeus	Phanerophytes	Tojo	Forest
	Vicia sativa L.	Vícia sativa	Therophytes	Ervilhaca	Ruderal
LiLiaceae	*Asparagus acutifolius* L.	Aspáragus acutifólius	Phanerophytes	Espargo-bravo-menor	Forest
	Nothoscordum gracile (Dryand. ex Aiton) Stearn.	Nothoscórdum grácile	Geophytes	Alho-sem-mau-cheiro	Ruderal
	Ruscus aculeatus L.[2]	Rúscus aculeátus	Geophytes	Gilbardeira	Forest
	Scilla monophyllos Link.	Scílla monophýllos	Geophytes	Cebola-albarrã	Forest

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
LiLiaceae	*Simethis mattiazzii* (Vandelli) Sacc.	Siméthis mattiázzii	Geophytes	Cravo-do-monte	Forest
Linaceae	*Linum bienne* Mill.	Línum biénne	Hemicryptophytes	Linho-bravo	Ruderal
Lythraceae	*Lythrum junceum* Banks & Sol.	Lýthrum júnceum	Hemicryptophytes	Erva-sapa	Riparian
	Lythrum salicaria L.	Lýthrum salicária	Hemicryptophytes/ Helophytes	Salgueirinha	Riparian
Malvaceae	*Lavatera cretica* L.	Lavátera crética	Therophytes	Malva-bastarda	Ruderal
	Modiola caroliniana (L.) G. Don.	Modíola caroliniána	Hemicryptophytes	--------	Riparian
Myrtaceae	*Eucalyptus globulus* Labill.	Eucalúptus glóbulus	Phanerophytes	Eucalipto	Forest
	Myrtus communis L.	Mýrtus commúnis	Phanerophytes	Murta	Forest
Nymphaeaceae	*Nymphaea alba* L.	Nymphéa álba	Hydrophytes	Nenúfar	Aquatic
Oleaceae	*Fraxinus angustifolia* Vahl.	Fráxinus angustifólia	Phanerophytes	Freixo-comum	Riparian
	Fraxinus ornus L.	Fráxinus órnus	Phanerophytes	Freixo orneiro	Riparian - Ornamental

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Oleaceae	*Ligustrum vulgare* L.	Ligústrum vulgáre	Phanerophytes	Alfena	Riparian-Ornamental
	Olea europaea L. subsp *europaea*	Ólea europáea	Phanerophytes	Oliveira	Ruderal - cultivate
Osmundaceae	*Osmunda regalis* L.	Osmúnda regális	Hemicryptophytes	Feto-real	Riparian
Papaveraceae	*Fumaria capreolata* L.	Fumária capreoláta	Therophytes	Catarinas Queimadas	Ruderal
	Fumaria muralis Sond. ex W.D.J. Koch.	Fumária murális	Therophytes	Fumária-das-paredes	Ruderal
	Papaver dubium L.	Papáver dúbium	Therophytes	Papoila-longa	Ruderal
Pinaceae	*Pinus pinaster* Aiton.	Pínus pináster	Phanerophytes	Pinheiro-bravo	Forest
Plantaginaceae	*Plantago lanceolata* L.	Plantágo lanceoláta	Hemicryptophytes	Lingua-de-ovelha	Ruderal
	Plantago major L.	Plantágo májor	Hemicryptophytes	Tanchagem-maior	Riparian
Platanaceae	*Platanus hispanica* Mill. ex Munchh.	Plátanus hispánica	Phanerophytes	Plátano-comum	Riparian - Ornamental

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Polygonaceae	*Polygonum hydropiper* L.	Polýgonum hydrópiper	Therophytes	Pimenta-da-água	Riparian
	Rumex conglomeratus Murray.	Rúmex conglomerátus	Hemicryptophytes	Labaça-ordinária	Riparian
	Rumex crispus L.	Rúmex críspus	Hemicryptophytes	Labaça-crespa	Riparian
	Rumex obtusifolius L.	Rúmex obtusifólius	Hemicryptophytes	Labaça-obtusa	Riparian
Pontederiaceae	*Eichhornia crassipes* (Mart.) Solms[1]	Eichhórnia crássipes	Hydrophytes	Jacinto-aquático	Aquatic
Primulaceae	*Anagallis arvensis* L.	Anagállis arvénsis	Therophytes	Morrião	Ruderal
	Lysimachia vulgaris L.	Lysimachía vulgáris	Helophytes/ Hemicryptophytes	Erva-moedeira	Riparian
Proteaceae	*Hakea sericea* Schrader.[1]	Hákea serícea	Phanerophytes	Háquea-picante	Ruderal
Ranunculaceae	*Ranunculus bulbosus* L. subsp. *bulbosos*	Ranúnculus bulbósus	Geophytes	Ranúnculo-bulboso	Riparian
	Ranunculus ficaria L.	Ranúnculus ficária	Geophytes	Erva-hemorroidal	Riparian
	Ranunculus repens L.	Ranúnculus répens	Hemicryptophytes	Botão-de-oiro	Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Ranunculaceae	*Thalictrum speciosissimum* L.	Thalíctrum speciosíssimum	Hemicryptophytes	Ruibarbo	Riparian
Resedaceae	*Reseda media* Lag.	Reséda média	Therophytes	Reseda-brava	Ruderal
Rhamnaceae	*Frangula alnus* Mill.	Frángula álnus	Phanerophytes	Amieiro-negro Sanguinho-de-água	Riparian
	Rhamnus alaternus L.	Rhámnus alatérnus	Phanerophytes	Aderno	Forest
Rosaceae	*Crataegus monogyna* Jacq.	Cratáegus monógyna	Phanerophytes	Escambrulheiro Pilriteiro	Riparian
	Cydonia oblonga Mill.	Cydónia oblónga	Phanerophytes	Marmeleiro	Ruderal-Cultivate
	Potentilla erecta (L.) Raeusch.	Potentílla erécta	Hemicryptophytes	Sete-em-rama	Riparian
	Pyrus cordata Desv.	Pýrus cordáta	Phanerophytes	Pereira-brava	Riparian
	Rosa micrantha Borrer ex Sm.	Rósa micrántha	Phanerophytes	Roseira-das-folhas-glandulosas	Forest
	Rosa sempervirens L.	Rósa sempérvirens	Phanerophytes	Roseira-brava	Riparian

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Rosaceae	*Rubus ulmifolius* Schott.	Rúbus ulmifólius	Phanerophytes	Silva	Forest
	Sorbus aucuparia L.	Sórbus aucupária	Phanerophytes	Tramazeira	Forest
Rubiaceae	*Galium palustre* L.	Gálium palústre	Geophytes		Riparian
	Rubia peregrina L.	Rúbia peregrína	Chamaephytes	Ruiva-brava	Forest
Salicaceae	*Populus alba* L.	Pópulus álba	Phanerophytes	Álamo-branco	Riparian-Ornamental
	Populus nigra L.	Pópulus nígra	Phanerophytes	Álamo-preto	Riparian
	Salix alba L.	Sálix álba	Phanerophytes	Vimieiro-branco	Riparian
	Salix atrocinerea Brot.	Sálix atrocinérea	Phanerophytes	Borrazeira-preta	Riparian
	Salix babylonica L.	Sálix babylonica	Phanerophytes	Salgueiro-chorão	Riparian-Ornamental
	Salix viminalis L.	Sálix viminális	Phanerophytes	Vimeiro	Riparian
Scrophulariaceae	*Digitalis purpurea L. subsp. purpurea*	Digitális purpúrea	Hemicryptophytes	Dedaleira	Riparian
	Misopates orontium (L.) Raf.	Misópates oróntium	Therophytes	Focinho-de-rato	Ruderal

Family	Species	Phonetics	Life form	Common Portuguese name	Habitat
Scrophulariaceae	*Parentucellia viscosa* (L.) Caruel.	Parentucéllia viscósea	Therophytes	Erva-peganhenta	Riparian
	Veronica anagallis- aquatica L. subsp. *anagallis aquatica*	Verónica anagállis-aquática	Helophytes	--------	Riparian
	Veronica persica Poir.	Verónica pérsica	Therophytes	Verónica-da-pérsia	Ruderal
Smilacaceae	*Smilax aspera* L.	Smílax áspera	Phanerophytes	Alegra-campo	Riparian
Solanaceae	*Datura stramonium* L.[1]	Datúra stramónium	Therophytes	Erva-do-diabo	Ruderal
	Solanum chenopodioides Lam.	Solánum chenopodioídes	Chamaephytes	--------	Ruderal
Thymelaeaceae	*Daphne gnidium* L.	Dáphne gnídium	Phanerophytes	Trovisco	Forest
Typhaceae	*Typha latifolia* L.	Týpha latifólia	Helophytes	Tabúa-larga	Riparian
Ulmaceae	*Ulmus minor* Mill.	Úlmus mínor	Phanerophytes	Ulmeiro	Riparian
Umbelliferae	*Angelica sylvestris* L.	Angélica sylvéstris	Hemicryptophytes	Angélica-silvestre	Riparian
	Hydrocotyle vulgaris L.	Hydrocótyle vulgáris	Helophytes	Trevão	Riparian
	Oenanthe crocata L.	Oenánthe crocáta	Geophytes	Embude	Riparian

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Urticaceae	*Urtica dioica* L.	Urtíca dióica	Hemicryptophytes	Urtiga-maior	Ruderal
Valerianaceae	*Centranthus calcitrapae* (L.) Dufr.	Centránthus calcitrápae	Therophytes	Calcitrapa	Ruderal
Violaceae	*Viola riviniana* Rchb.	Víola riviniána	Hemicryptophytes	Violetas-bravas	Riparian
Vitaceae	*Vitis vinifera* L.	Vítis viníféra	Phanerophytes	Cepa Videira	Ruderal- Cultivate

1 Invasive species list in the Portuguese law decree nº 565/99 December 21th, 1999.

2Protected species in Annex V Habitats Directive (Directiva 92/43/CEE)